FCC 47 CFR PART 27

RF Test Report

Product Type	:	M2M Advanced Industrial Gateway
Applicant	:	Coretex Ltd
Address	:	Level 2, 135 Broadway,Newmarket, Auckland, New Zealand, 1023
Trade name	:	ibright
Model No.	:	TMU-1500
Test Specification	:	FCC 47 CFR PART 27 ANSI/TIA-603-D 2010
Application Purpose	:	Original
Receive Date	:	Oct. 05, 2015
Test Period	:	Oct. 12 ~ Dec. 05, 2015
Issue Date	:	Dec. 29, 2015

Issue by

A Test Lab Techno Corp.
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Taiwan Accreditation Foundation accreditation number: 1330

Revision History

Rev.	Issue Date	Revisions	Revised By
00	Dec. 18, 2015	Initial Issue	
01	Dec. 29, 2015	Revised report information.	Peggy Chang

Verification of Compliance

Issued Date: 12/29/2015

Product Type	:	M2M Advanced Industrial Gateway
Applicant	:	Coretex Ltd
Address	:	Level 2, 135 Broadway,Newmarket, Auckland, New Zealand, 1023
Trade Name	:	ibright
Model Number	:	TMU-1500
FCC ID	:	2AGNLTMU1500
EUT Rated Voltage	:	DC 5 ~ 32V
Test Voltage	:	DC 12V
Applicable Standard	:	FCC 47 CFR PART 27 SUBPART L ANSI/TIA-603-D 2010
Application Purpose	:	Original
Test Result	:	Complied
Performing Lab.	:	A Test Lab Techno Corp. No. 140-1, Changan Street, Bade City, Taoyuan County 334, Taiwan R.O.C. Tel：+886-3-2710188 / Fax：+886-3-2710190 Taiwan Accreditation Foundation accreditation number: 1330 http://www.atl-lab.com.tw/e-index.htm

A Test Lab Techno Corp. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by A Test Lab Techno Corp. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Approved By	:	Fly Lu	Reviewed By	:	Eric Ou Yang
(Manager)		(Fly Lu)	(Testing Engineer)		(Eric Ou Yang)

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1 General Information

1.1. EUT Description

Applicant		Coretex Ltd			
Applicant Address		Level 2, 135 Broadway,Newmarket, Auckland, New Zealand, 1023			
Manufacturer		Coretex Ltd			
Manufacturer Address		Level 2, 135 Broadway,Newmarket, Auckland, New Zealand, 1023			
Product Type		M2M Advanced Industrial Gateway			
Trade Name		ibright			
Model Number		TMU-1500			
FCC ID		2AGNLTMU1500			
IMEI No.		357164045288860			
Mode	WCDMA (RMC 12.2K)	Band	UL Frequency (MHz)	DL Frequency (MHz)	Modulation
		IV	1712.4 ~ 1752.6	2112.4 ~ 2152.6	QPSK
Type of Antenna		Super Combo Antenna			
Antenna Gain (dBi)		3.3 dBi			
Max. RF Output Power		26.70 dBm / 0.468 W			
Max. EIRP		22.57 dBm / 0.181 W			

1.2. Mode of Operation

ATL has verified the construction and function in typical operation. All the test modes were carried out with the EUT in normal operation, which was shown in this test report and defined as:

Test Mode
Mode 1: WCDMA Band IV Link Mode

Note: Regards to the frequency band operation: the lowest, middle and highest frequency of channel were selected to perform the test, then shown on this report.

Tested System Details

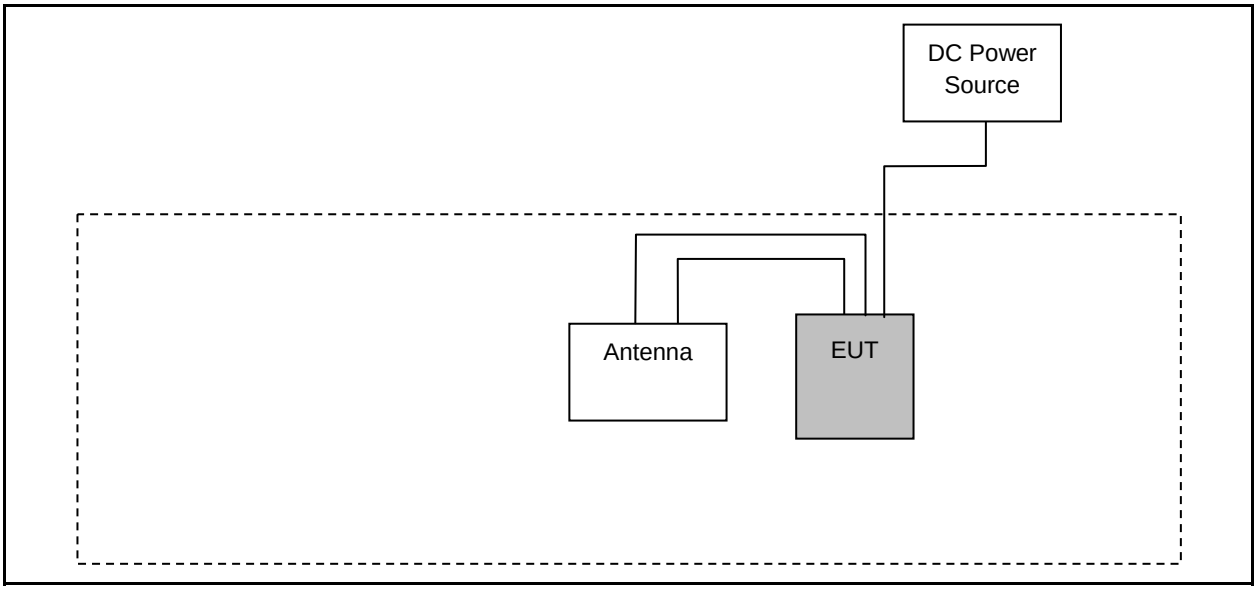
The types for all equipments, plus descriptions of all cables used in the tested system (including inserted cards) are:

	Product	Manufacturer	Model No.	Serial No.	Power Cord
1.	Universal Radio Communication Tester	R&S	CMU200	109369	N/A

1.3. EUT Exercise Software

1.	Setup the EUT and Base Station (CMU200) as shown on 1.4.
2.	Turn on the power of all equipment.

1.4. Configuration of Test System Details



1.5. Test Site Environment

Items	Required (IEC 60068-1)	Actual
Temperature (°C)	15-35	26
Humidity (%RH)	25-75	60
Barometric pressure (mbar)	860-1060	950

1.6. Summary of Test Result

FCC Rule	Description	Result
§2.1046	Conducted Output Average Power	Pass
§27. 50	Equivalent Isotropic Radiated Power / Equivalent Radiated Power	Pass
§2.1055 §27. 54	Frequency Stability	Pass
§2.1049	Emission Bandwidth & Occupied Bandwidth	Pass
§27.50	Peak to average ratio	Pass
§27.53	Band Edge	Pass
§2.1051 §27.53	Conducted Spurious Emissions	Pass
§2.1053 §27.53	Radiated Spurious Emissions	Pass

2 RF Output Power Test

2.1. Limit

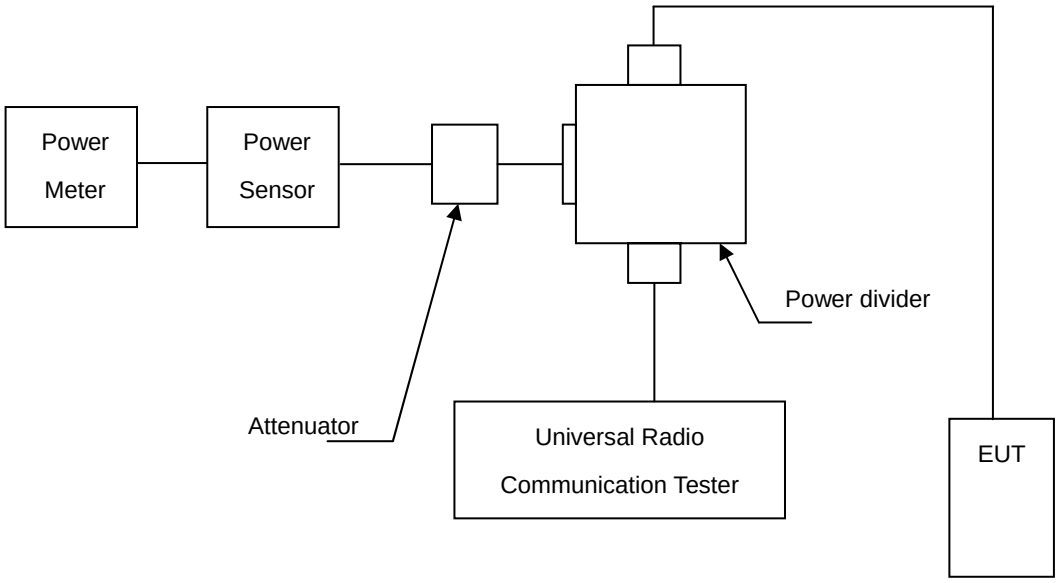
N/A

2.2. Test Instruments

Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Remark
Universal Radio Communication Tester	ROHDE & SCHWARZ	CMU200	109369	10/21/2014	(2)
Single Channel PK Power Sensor	Agilent	N1911A	MY45101619	12/15/2014	(1)
Wideband Power Meter	Agilent	N1921A	MY45241957	12/15/2014	(1)
Test Site	ATL	TE05	TE05	N.C.R.	-----

Remark: (1) Calibration period 1 year. (2) Calibration period 2 years.
Note: N.C.R. = No Calibration Request.

2.3. Test Setup



2.4. Test Procedure

The measurement is made according to as follows:

1. The transmitter output was connected to power meter and base station through power divider.
2. Set base station for EUT at WCDMA Band IV, power level was set to maximum.
3. Select lowest, middle, and highest channels for each band.

HSDPA Data Devices setup

Sub-test	βc	βd	βd (SF)	βc/βd	βhs(1,2)	CM (dB)(3)	MRP (dB)(3)
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15(4)	15/15(4)	64	12/15(4)	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note

1. Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 8 ⇔ Ahs = βhs/βc = 30/15 ⇔ βhs= 30/15 *βc
2. For theHS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude(EVM) with HS-DPCCH test in clause 5.13.1A and HSDPA EVM with phase discontinuity in clause 5.13.1AA, Δ_{ACK} and Δ_{NACK} = 30/15 with βhs = 30/15 *βc and Δ_{CQI} = 24/15 with βhs = 24/15*βc
3. CM = 1 for βc/βd =12/15, βhs/βc=24/15. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.
4. For subtest 2 the βc/βd ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to βc = 11/15 and βd = 15/15.

Table 1. Setup for Release 5 HSDPA

2.5. Uncertainty

The measurement uncertainty is defined as for RF output power measurement is 1.2 dB.

2.6. Test Result

Model Number	TMU-1500					
Test Item	RF Output Power					
Date of Test	10/12/2015				Test Site	TE05
Bands	Sub-Test	Frequency (MHz)	Average Power		Peak Power	
			(dBm)	(W)	(dBm)	(W)
WCDMA IV (RMC 12.2K)	-----	1712.4	23.28	0.213	26.44	0.441
		1732.6	23.52	0.225	**26.70**	**0.468**
		1752.6	23.43	0.220	26.59	0.456
HSDPA IV	1	1712.4	22.27	0.169	25.43	0.349
		1732.6	22.49	0.177	25.66	0.368
		1752.6	22.39	0.173	25.54	0.358
	2	1712.4	21.75	0.150	24.90	0.309
		1732.6	21.97	0.157	25.13	0.326
		1752.6	21.87	0.154	25.01	0.317
	3	1712.4	21.73	0.149	24.88	0.308
		1732.6	21.95	0.157	25.11	0.324
		1752.6	21.85	0.153	24.99	0.316
	4	1712.4	22.18	0.165	25.32	0.340
		1732.6	22.40	0.174	25.55	0.359
		1752.6	22.30	0.170	25.43	0.349
HSUPA/HSPA+ IV	1	1712.4	21.65	0.146	24.82	0.303
		1732.6	21.84	0.153	25.01	0.317
		1752.6	21.78	0.151	24.98	0.315
	2	1712.4	19.64	0.092	22.80	0.191
		1732.6	19.83	0.096	22.99	0.199
		1752.6	19.77	0.095	22.96	0.198
	3	1712.4	20.60	0.115	23.74	0.237
		1732.6	20.79	0.120	23.93	0.247
		1752.6	20.73	0.118	23.90	0.245
	4	1712.4	19.62	0.092	22.77	0.189
		1732.6	19.81	0.096	22.96	0.198
		1752.6	19.75	0.094	22.93	0.196
	5	1712.4	21.54	0.143	24.69	0.294
		1732.6	21.73	0.149	24.88	0.308
		1752.6	21.67	0.147	24.85	0.305

Note: The testing result was used peak detector.

3 Effective Radiated Power / Equivalent Isotropic Radiated Power Test

3.1. Limit

For FCC Part 27.50(d)(2): The EIRP of mobile transmitters are limited to 1 watt for 1710~1755 MHz.

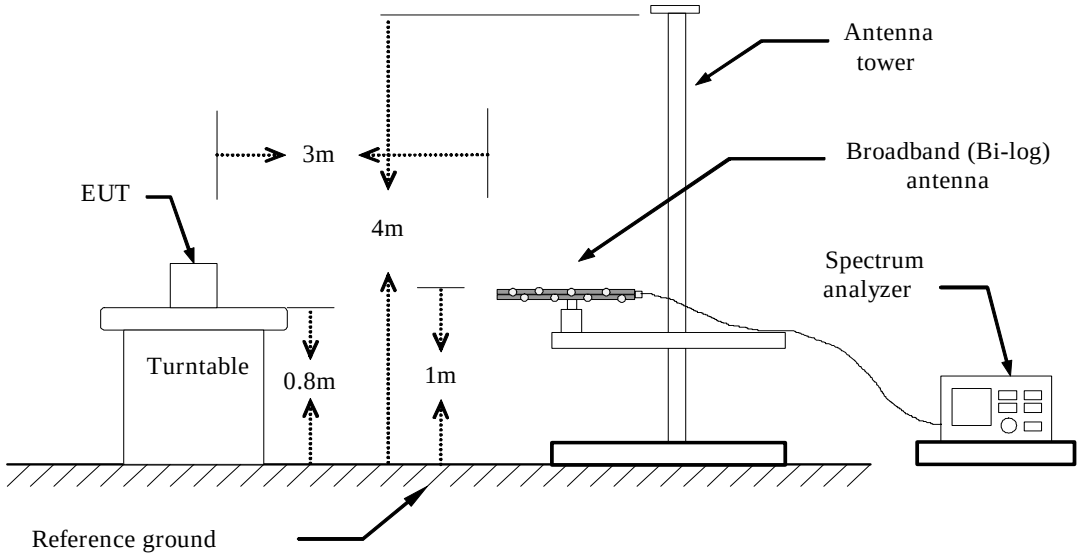
3.2. Test Instruments

3 Meter Chamber					
Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
RF Pre-selector	Agilent	N9039A	MY46520256	01/06/2015	(1)
Spectrum Analyzer	Agilent	E4446A	MY46180578	01/06/2015	(1)
Pre Amplifier	Agilent	8449B	3008A02237	02/24/2015	(1)
Pre Amplifier	Agilent	8447D	2944A10961	02/24/2015	(1)
Broadband Antenna (30MHz~1GHz)	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	9163-270	08/11/2015	(1)
Sleeve Dipole(CF880) (780-980MHz)	ETS	3126-880	00064344	10/06/2014	(2)
Sleeve Dipole(CF1845) (1695-1995MHz)	ETS	3126-1845	00083335	10/06/2014	(2)
Horn Antenna (1~18GHz)	ETS	3117	00152321	08/14/2015	(1)
Horn Antenna (1~18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA9120D	9120D-550	06/12/2015	(1)
Horn Antenna (18~40GHz)	ETS	3116	00086467	09/01/2015	(1)
Horn Antenna (18~40GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA9170	9170-320	07/06/2015	(1)
Test Site	ATL	TE01	888001	08/27/2015	(1)

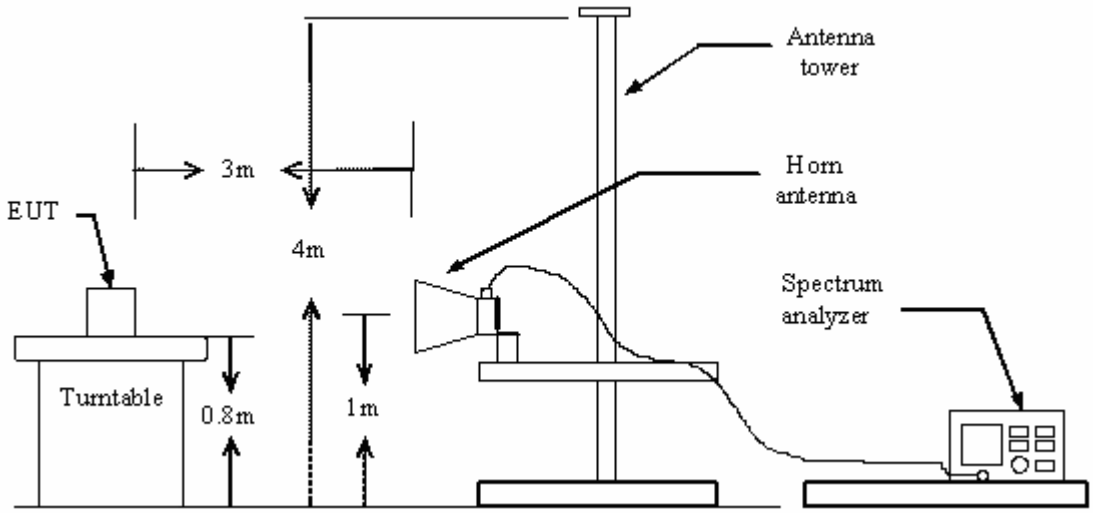
Remark: (1) Calibration period 1 year. (2) Calibration period 2 years.
Note: N.C.R. = No Calibration Request.

3.3. Test Setup

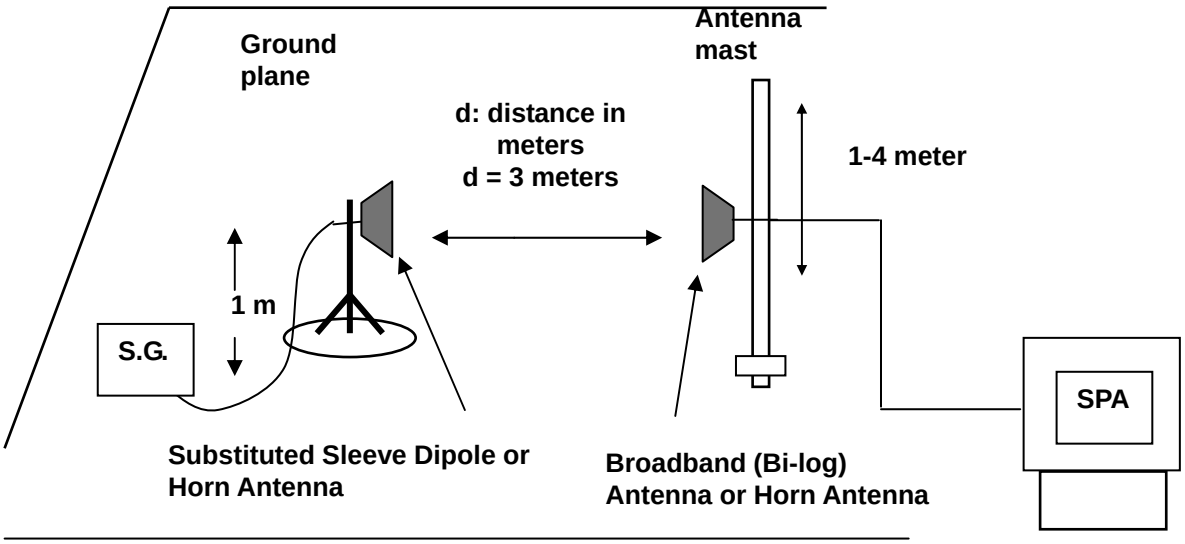
Below 1 GHz



Above 1 GHz



For Substituted Method Test Set-UP



3.4. Test Procedure

a. The EUT was set up for the maximum power. The power was measured with Spectrum Analyzer. All measurements were done at 3 channels (low, middle and high operational frequency range).

b. Radiation Emission measurement. In the semi-anechoic chamber, EUT placed on the 0.8m height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power. The “Read Value” is the spectrum reading the maximum power value.

c. The substitution antenna (Note:3 & 4) is substituted for EUT at the same position and signals generator export the CW signal to the substitution antenna via a TX cable. Rotated the Turn Table and moved receiving antenna to find the maximum radiation power. Adjust output power level of S.G to get a Value of spectrum reading equal to “Read Value” of step a. Record the power level of S.G.

d. E.I.R.P. = Output power level of S.G - TX cable loss + Antenna gain of substitution horn

e. E.R.P. = E.I.R.P- 2.15 dB

Note: 1. For WCDMA and CDMA signals, a peak detector is used with RBW = VBW = 5MHz.

2. For AMPS, GSM, and NADC TDMA signals, a peak detector is used, with RBW = VBW= 1 MHz.

3. Below 1 GHz Substituted Method Test：Sleeve dipole antenna to Bi-Log Antenna

4. Above 1 GHz Substituted Method Test：Horn antenna to Horn Antenna

3.5. Uncertainty

The measurement uncertainty is defined as for Field Strength of Spurious Radiation measurement is ± 3.072 dB.

3.6. Test Result

Model Number	TMU-1500						
Test Item	E.I.R.P.						
Test Mode	Mode 1						
Date of Test	12/05/2015				Test Site	TE01	
Bands	Frequency (MHz)	Ant. Polar.	Read Level (dBm)	Correction factor (dB)	E.IR.P.		Limit (W)
					(dBm)	(W)	
WCDMA IV (RMC 12.2K)	1712.4	H	9.96	10.06	20.02	0.100	< 1
		V	12.31	10.07	22.38	0.173	< 1
	1732.6	H	10.61	10.05	20.66	0.116	< 1
		V	12.52	10.05	**22.57**	**0.181**	< 1
	1752.6	H	10.10	10.06	20.16	0.104	< 1
		V	12.38	10.04	22.42	0.175	< 1

Note: 1. ERP/EIRP = Read Level + Correction factor.

2. For WCDMA and CDMA signals, a peak detector is used with RBW = VBW = 5MHz.

3. For AMPS, GSM, and NADC TDMA signals, a peak detector is used, with RBW = VBW= 1 MHz.

4 Peak to Average Ratio Test

4.1. Limit

In measuring transmissions in this band using an average power technique, the peak to-average ratio (PAR) of the transmission may not exceed 13 dB.

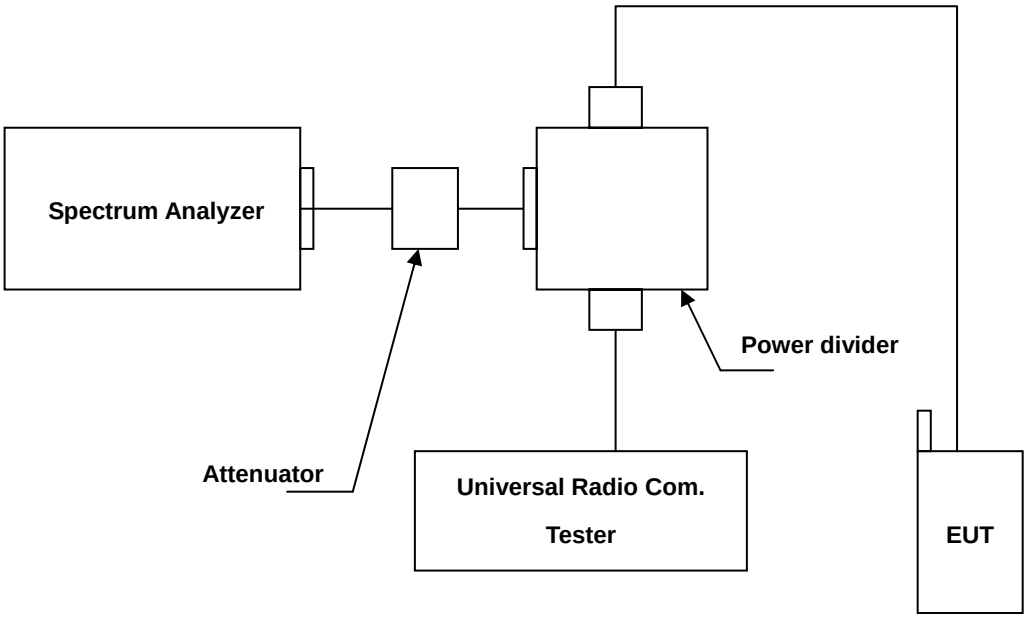
4.2. Test Instruments

Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Remark
Spectrum Analyzer	Agilent	E4445A	MY46181986	05/14/2015	(1)
Wideband Radio Communication Test	R & S	CMW500	103168	11/05/2014	(1)
Attenuator	RADIALL	R41572000	0603033073	N.C.R.	-----
Power divider	Agilent	87302C	3239A00760	N.C.R.	-----
Test Site	ATL	TE05	TE05	N.C.R.	-----

Remark: (1) Calibration period 1 year. (2) Calibration period 2 years.

Note: N.C.R. = No Calibration Request.

4.3. Setup



4.4. Test Procedure

The measurement is made according to FCC rules part 27:

a. Set resolution/measurement bandwidth signal's occupied bandwidth;

b. Set the number of counts to a value that stabilizes the measured CCDF curve;

c. Record the maximum PAPR level associated with a probability of 0.1%.

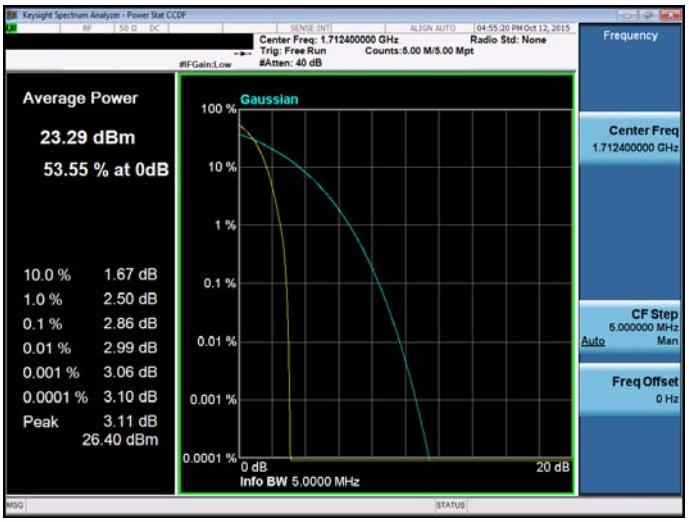
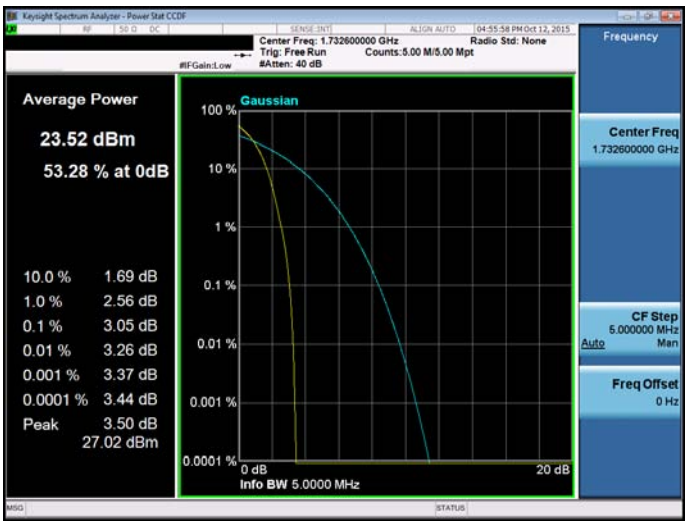
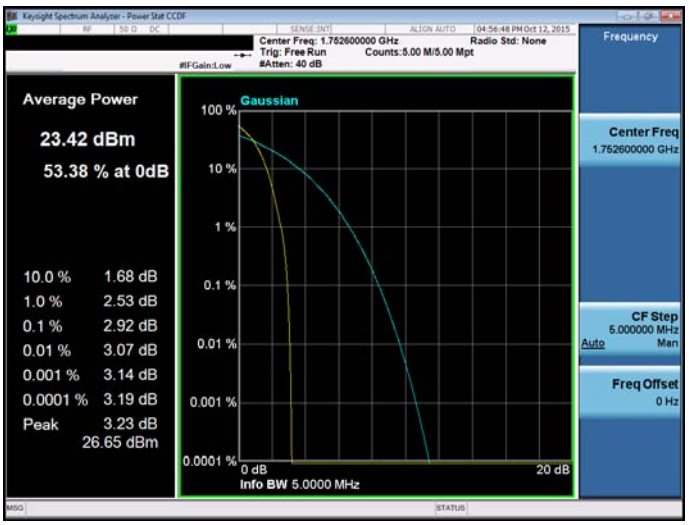
4.5. Uncertainty

The measurement uncertainty is defined as for Conducted Power measurement is 1.2 dB.

4.6. Test Result

Model Number	TMU-1500				
Test Item	Peak to Average Ratio				
Test Mode	Mode 1				
Date of Test	10/12/2015			Test Site	TE05
Bands	Channel	Frequency (MHz)	Peak to Average Ratio (dB)	Limit (dB)	
WCDMA IV	1312	1712.4	2.86	< 13	
	1413	1732.6	3.05	< 13	
	1513	1752.6	2.92	< 13	

4.7. Test Graphs

Mode 1	
1712.4 MHz	
1732.6 MHz	
1752.6 MHz	

5 Emission Bandwidth & Occupied Bandwidth Test

5.1. Limit

The Occupied Bandwidth Limit:

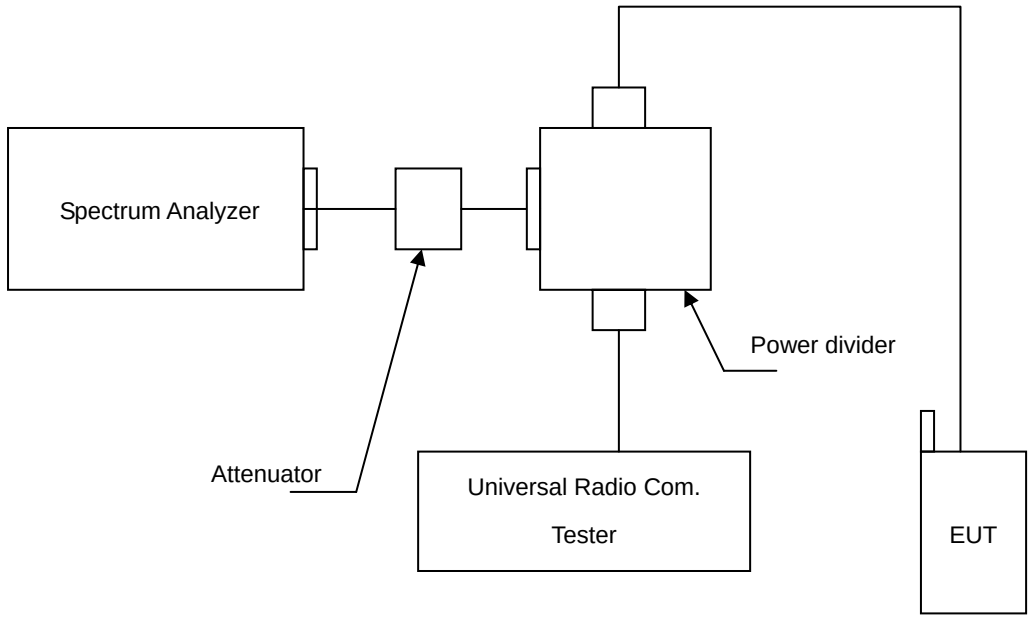
N/A.

5.2. Test Instruments

Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Remark
Universal Radio Communication Tester	R & S	CMU200	109369	10/21/2014	(2)
Spectrum Analyzer	Agilent	E4445A	MY46181986	05/14/2015	(1)
Attenuator	RADIALL	R41572000	0603033073	N.C.R.	-----
Power Divider	Agilent	87302C	3239A00760	N.C.R.	-----
Test Site	ATL	TE05	TE05	N.C.R.	-----

Remark: (1) Calibration period 1 year. (2) Calibration period 2 years.
Note: N.C.R. = No Calibration Request.

5.3. Setup



5.4. Test Procedure

The measurement is made according to FCC rules part 27:

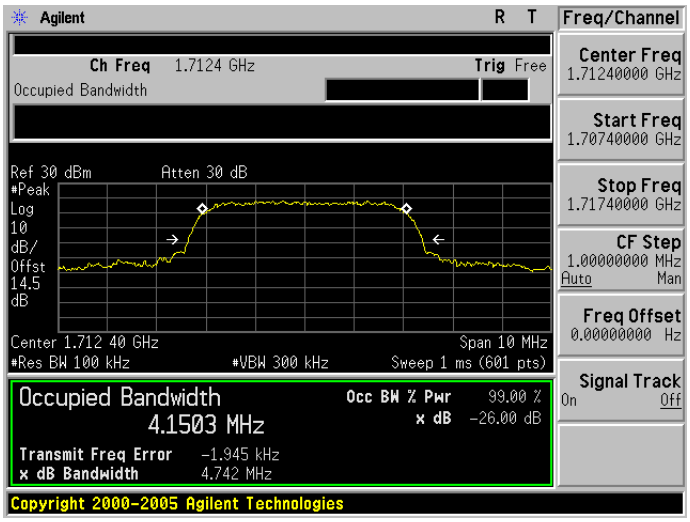
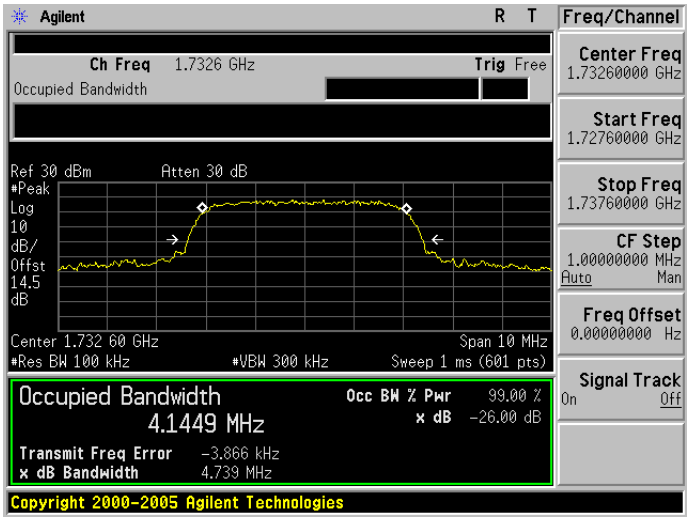
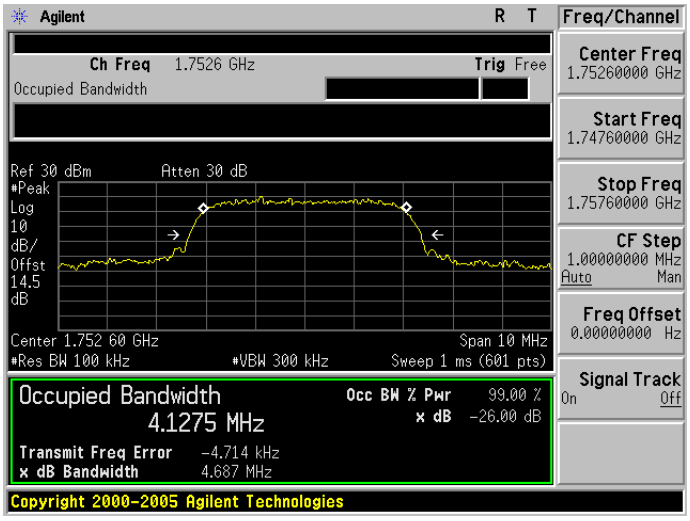
1. The EUT was connected to Spectrum Analyzer and Base Station via power divider.
2. The occupied bandwidth of middle channel for the highest and lowest RF powers was measured.

5.5. Uncertainty

The measurement uncertainty is defined as ± 10Hz

5.6. Test Result

Model Number	TMU-1500					
Test Item	Emission Bandwidth & Occupied Bandwidth					
Test Mode	Mode 1					
Date of Test	10/12/2015				Test Site	TE05
Channel No.	Frequency (MHz)	-26dB Bandwidth (MHz)	99 % Bandwidth (MHz)	Limit	Note	
1312	1712.4	4.742	4.1503	N/A	RBW:100kHz , VBW:300kHz	
1413	1732.6	4.739	4.1449	N/A	RBW:100kHz , VBW:300kHz	
1513	1752.6	4.687	4.1275	N/A	RBW:100kHz , VBW:300kHz	

Mode 1	
1712.4 MHz	
1732.6 MHz	
1752.6 MHz	

6 Band Edge Test

6.1. Limit

The Band Edge Limit:

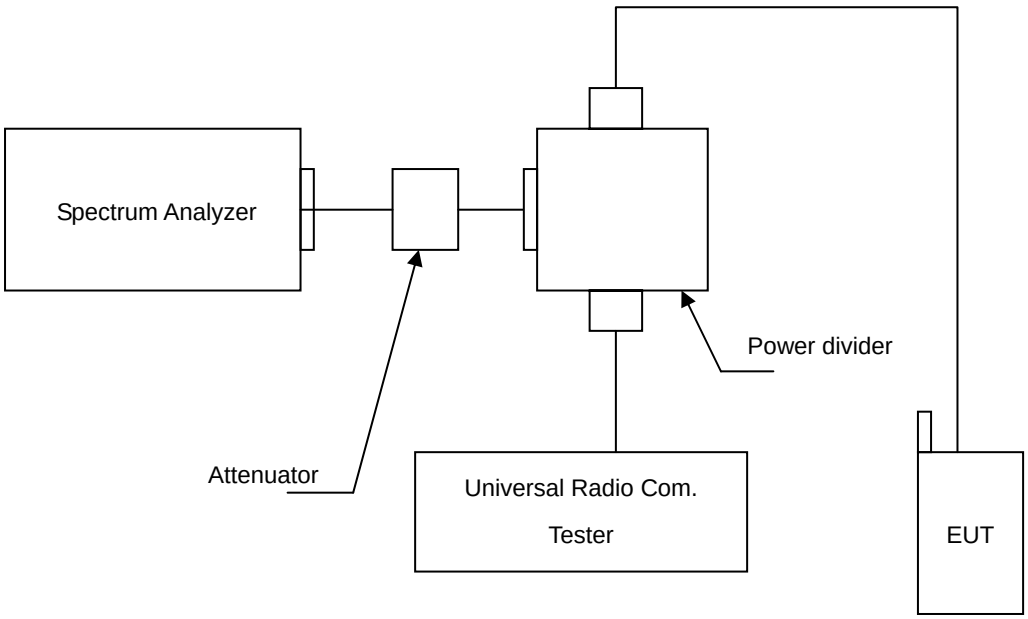
The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10log(P) dB.

6.2. Test Instruments

Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Remark
Universal Radio Communication Tester	R & S	CMU200	109369	10/21/2014	(2)
Spectrum Analyzer	Agilent	E4445A	MY46181986	05/14/2015	(1)
Attenuator	RADIALL	R41572000	0603033073	N.C.R.	-----
Power Divider	Agilent	87302C	3239A00760	N.C.R.	-----
Test Site	ATL	TE05	TE05	N.C.R.	-----

Remark: (1) Calibration period 1 year. (2) Calibration period 2 years.
Note: N.C.R. = No Calibration Request.

6.3. Setup



6.4. Test Procedure

The measurement is made according to FCC rules part 27:

1. The EUT was connected to Spectrum Analyzer and Base Station via power divider.
2. The band edge of low and high channels for the highest RF powers within the transmitting frequency band were measured. Setting RBW as roughly BW/100.
3. The band edge setting:RB=51 kHz; VB=160 kHz for WCDMA Band IV.

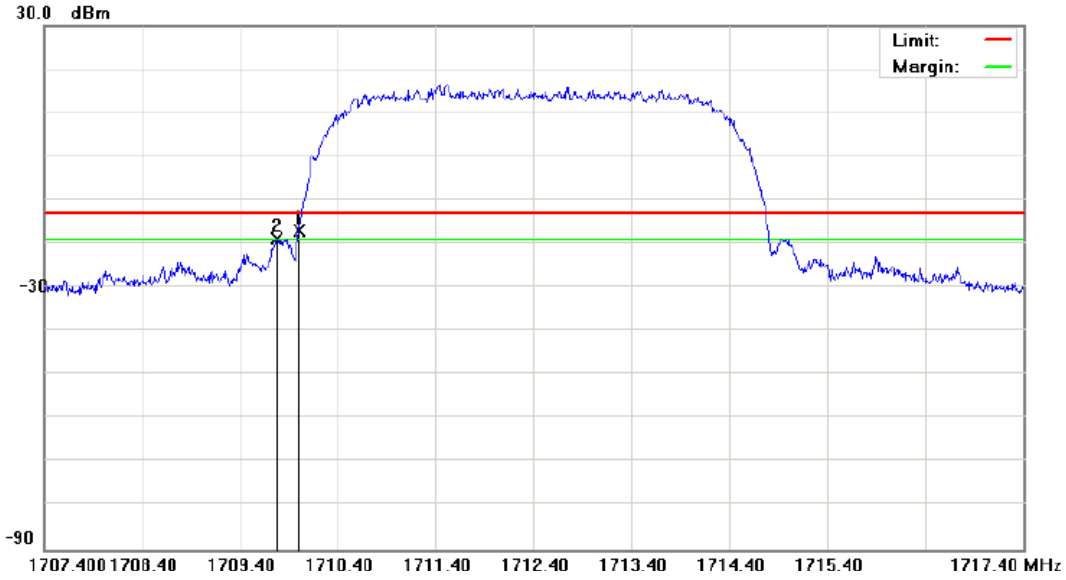
6.5. Uncertainty

The measurement uncertainty is defined as ± 10Hz

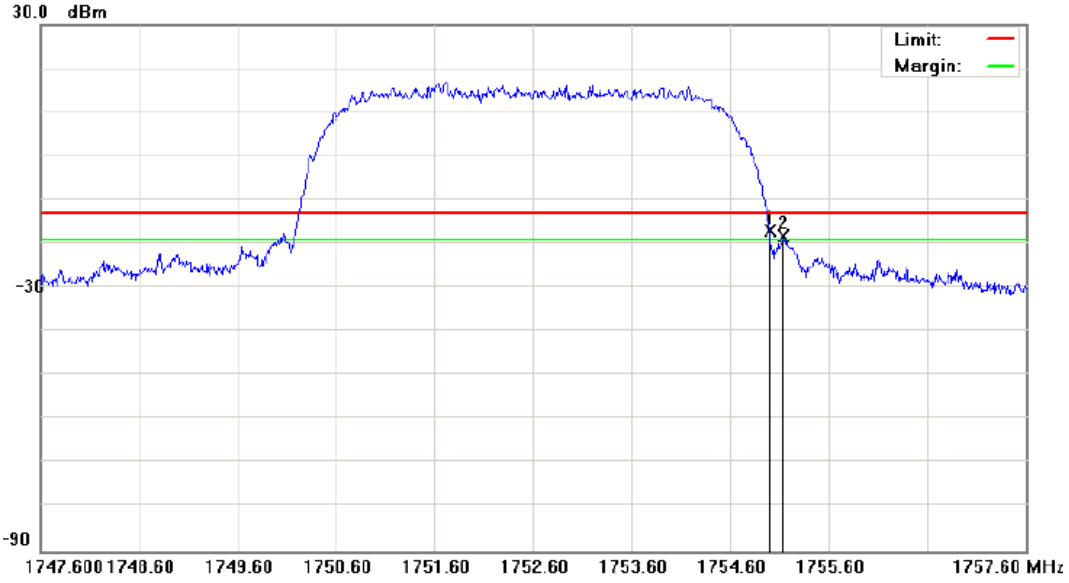
6.6. Test Result

Model Number	TMU-1500				
Test Item	Band Edge				
Test Mode	Mode 1				
Date of Test	10/12/2015		Test Site	TE05	
Band	Channel	Frequency (MHz)	Band Edge (dBm)	Limit (dBm)	Result
Lower	1312	1710.00	-16.83	-13	Pass
Higher	1513	1755.00	-16.82	-13	Pass

Lower Band



Higher Band



7 Conducted Spurious Emission Test

7.1. Limit

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10log(P) dB.

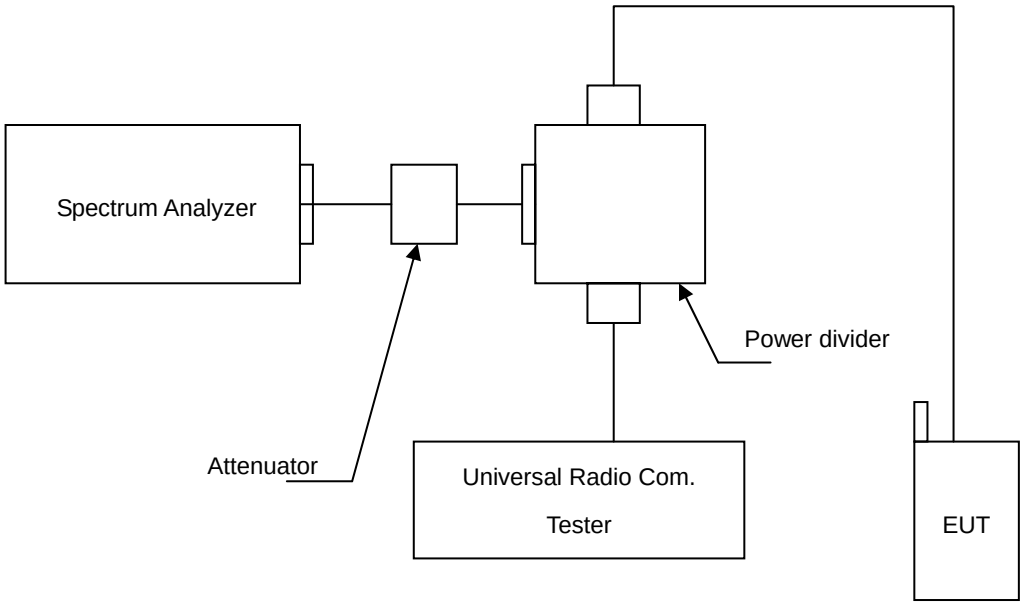
7.2. Test Instruments

Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Remark
Universal Radio Communication Tester	R & S	CMU200	109369	10/21/2014	(2)
Spectrum Analyzer	Agilent	E4445A	MY46181986	05/14/2015	(1)
Attenuator	RADIALL	R41572000	0603033073	N.C.R.	-----
Power Divider	Agilent	87302C	3239A00760	N.C.R.	-----
Test Site	ATL	TE05	TE05	N.C.R.	-----

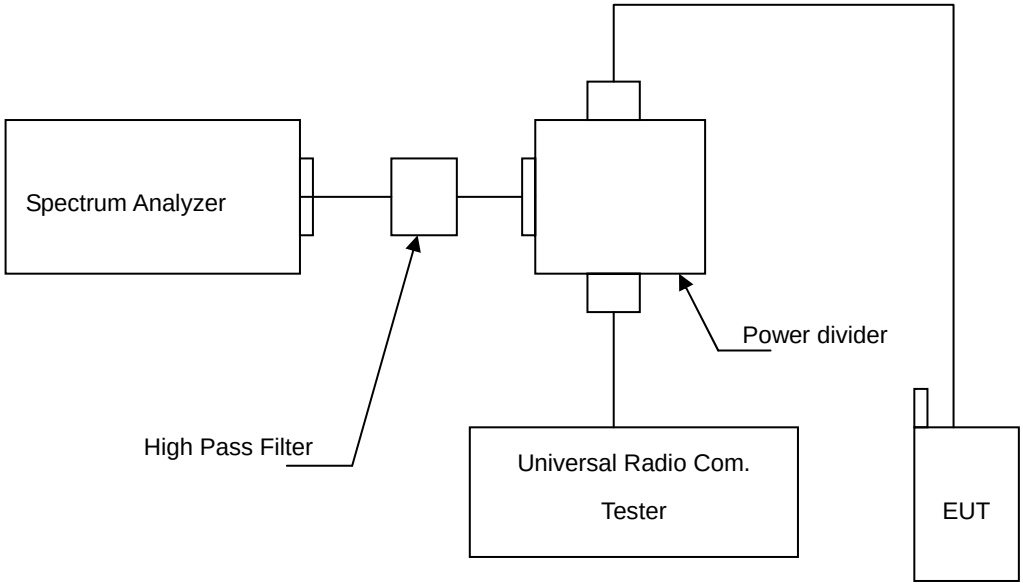
Remark: (1) Calibration period 1 year. (2) Calibration period 2 years.
Note: N.C.R. = No Calibration Request.

7.3. Setup

Below 2.8GHz



Above 2.8GHz



7.4. Test Procedure

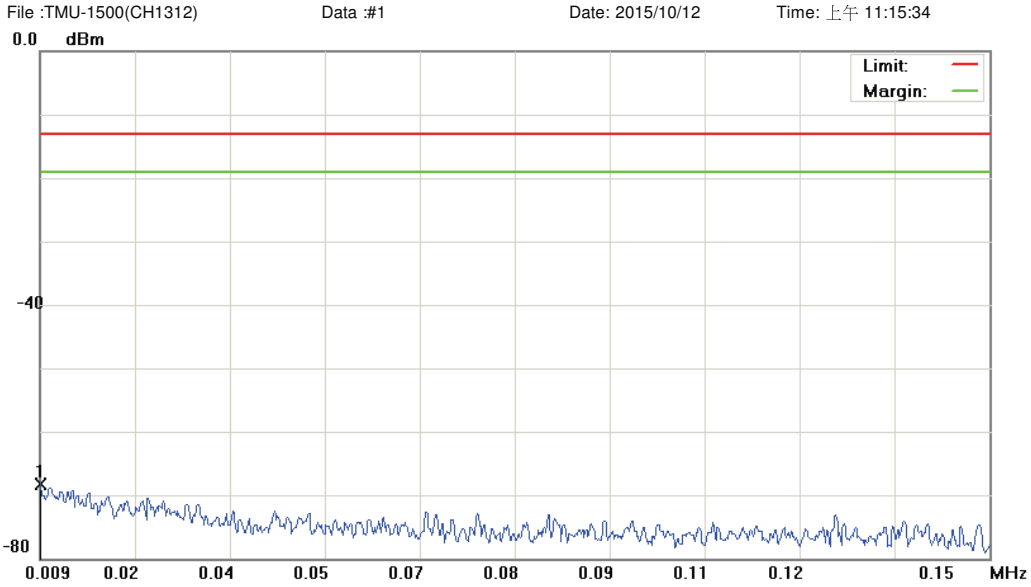
1. The EUT was connected to Spectrum Analyzer and Base Station via power divider.
2. The middle channel for the highest RF power within the transmitting frequency was measured.
3. The conducted spurious emission for the whole frequency range was taken.
4. Test setting at WCDMA Band IV RB=1MHz, VB=1MHz.

7.5. Uncertainty

The measurement uncertainty is evaluated as ± 2.24 dB.

7.6. Test Result

Model Number	TMU-1500		
Test Item	Conducted Spurious Emission		
Test Mode	Mode 1		
Date of Test	10/12/2015	Test Site	TE05



Site: site #1
Limit: FCC Part 27 conducted(9k-26.5G)
EUT: M2M Advanced Industrial Gateway
M/N: TMU-1500
Mode: WCDMA Band IV
Note:

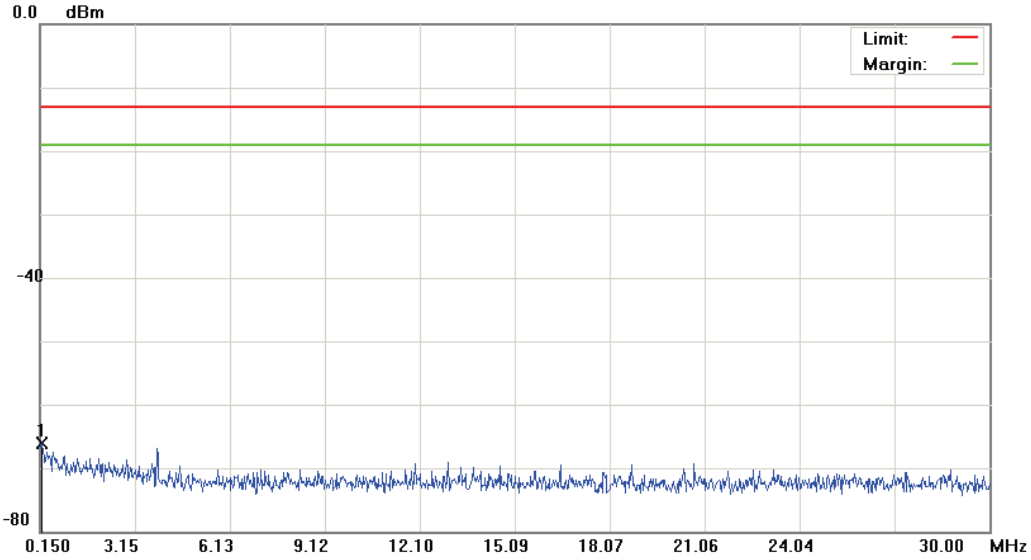
Polarization: Conducted Power
Power: DC 12V
Distance:

Temperature: 26 ℃
Humidity: 55 %
RBW: 1 KHz VBW: 3 KHz

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	Detector	cm	degree	Comment
1	*	0.0091	-79.52	11.32	-68.20	-13.00	-55.20	peak			

*:Maximum data x:Over limit !:over margin

File :TMU-1500(CH1312) Data :#2 Date: 2015/10/12 Time: 上午 11:15:58



Site: site #1
Limit: FCC Part 27 conducted(9k-26.5G)
EUT: M2M Advanced Industrial Gateway
M/N: TMU-1500
Mode: WCDMA Band IV
Note:

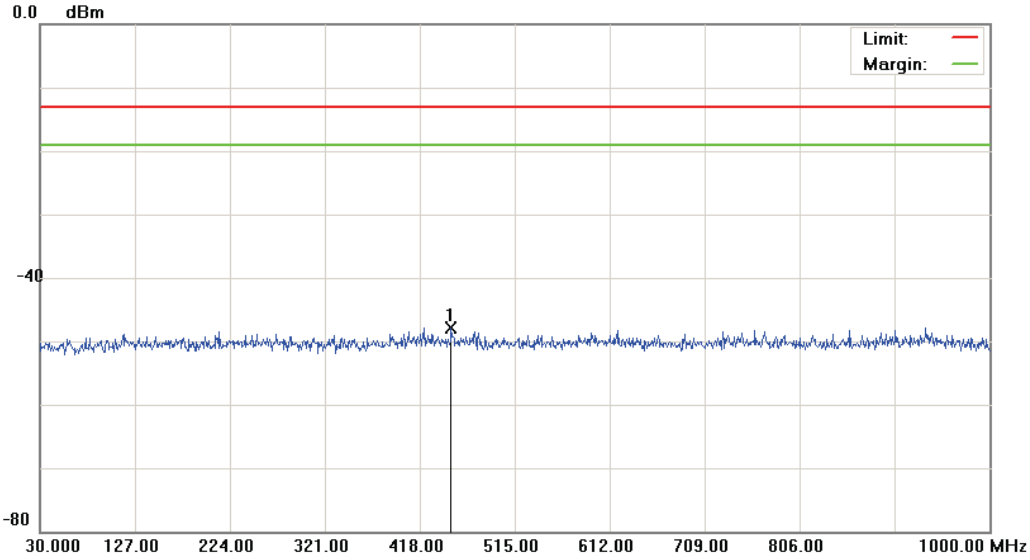
Polarization: Conducted Power
Power: DC 12V
Distance:

Temperature: 26 ℃
Humidity: 55 %
RBW: 10 KHz VBW: 30 KHz

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	Detector	cm	degree	Comment
1	*	0.2097	-78.61	12.44	-66.17	-13.00	-53.17	peak			

*:Maximum data x:Over limit !:over margin

File :TMU-1500(CH1312) Data :#3 Date: 2015/10/12 Time: 上午 11:16:22



Site: site #1
Limit: FCC Part 27 conducted(9k-26.5G)
EUT: M2M Advanced Industrial Gateway
M/N: TMU-1500
Mode: WCDMA Band IV
Note:

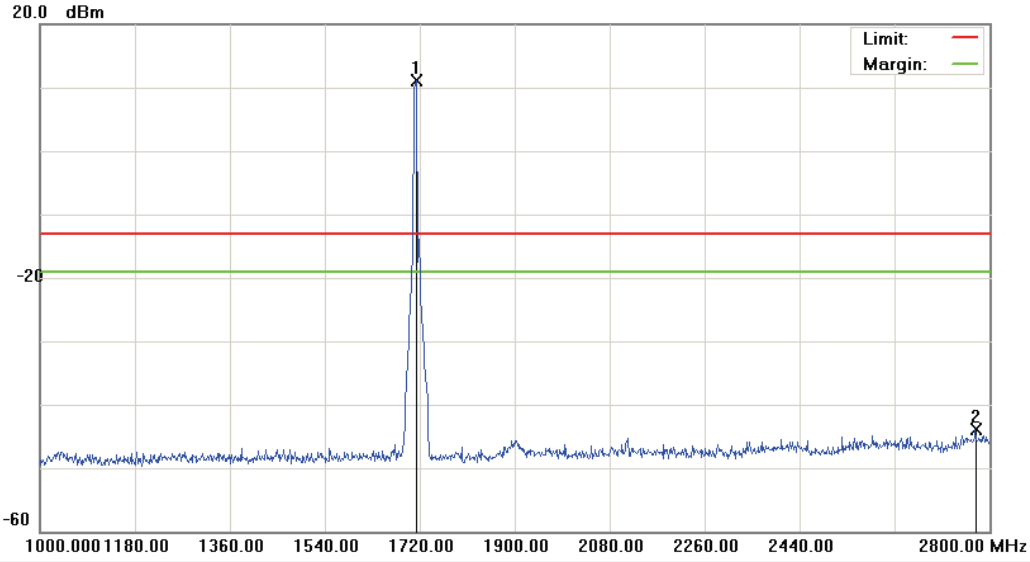
Polarization: Conducted Power
Power: DC 12V
Distance:

Temperature: 26 ℃
Humidity: 55 %
RBW: 100 KHz VBW: 300 KHz

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	Detector	cm	degree	Comment
1	*	450.0100	-61.06	13.21	-47.85	-13.00	-34.85	peak			

*:Maximum data x:Over limit !:over margin

File :TMU-1500(CH1312) Data :#4 Date: 2015/10/12 Time: 上午 11:22:23



Site: site #1
Limit: FCC Part 27 conducted(9k-26.5G)
EUT: M2M Advanced Industrial Gateway
M/N: TMU-1500
Mode: WCDMA Band IV
Note:

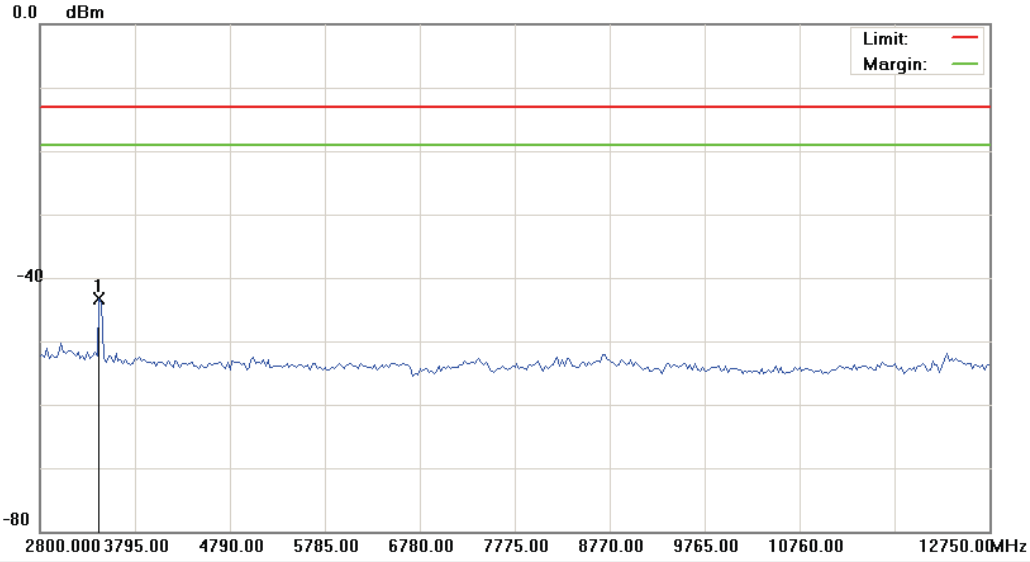
Polarization: Conducted Power
Power: DC 12V
Distance:

Temperature: 26 ℃
Humidity: 55 %
RBW: 1000 KHz VBW: 3000 KHz

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	Detector	cm	degree	Comment
1	*	1713.700	6.83	4.36	11.19	-13.00	24.19	peak			Tx
2		2773.900	-49.68	5.79	-43.89	-13.00	-30.89	peak			

*:Maximum data x:Over limit !:over margin

File :TMU-1500(CH1312) Data :#5 Date: 2015/10/12 Time: 下午 02:04:40



Site: site #1
Limit: FCC Part 27 conducted(9k-26.5G)
EUT: M2M Advanced Industrial Gateway
M/N: TMU-1500
Mode: WCDMA Band IV
Note:

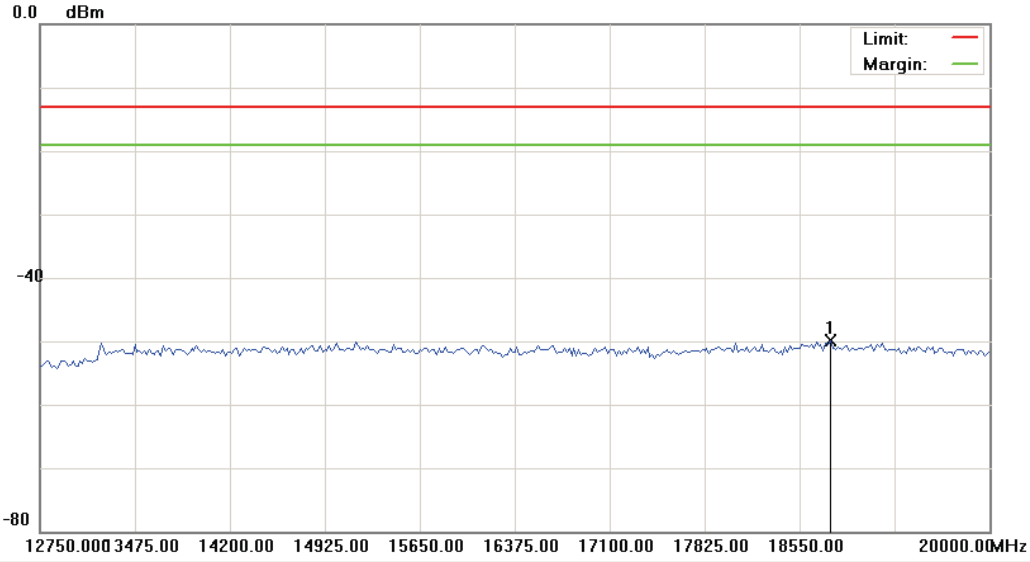
Polarization: Conducted Power
Power: DC 12V
Distance:

Temperature: 26 ℃
Humidity: 55 %
RBW: 1000 KHz VBW: 3000 KHz

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	Detector	cm	degree	Comment
1	*	3421.875	-48.44	5.06	-43.38	-13.00	-30.38	peak			

*:Maximum data x:Over limit !:over margin

File :TMU-1500(CH1312) Data :#6 Date: 2015/10/12 Time: 下午 02:05:00



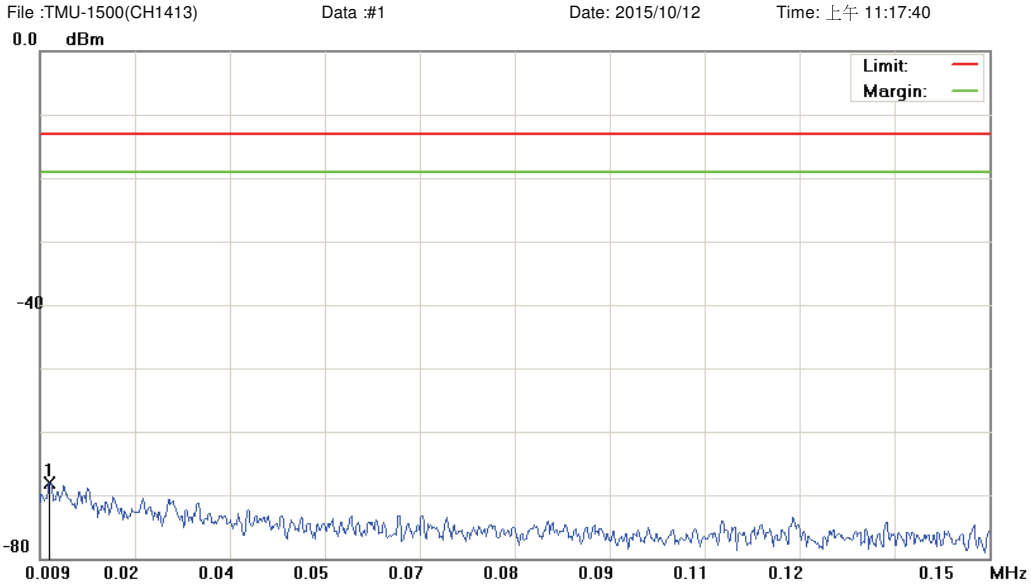
Site: site #1
Limit: FCC Part 27 conducted(9k-26.5G)
EUT: M2M Advanced Industrial Gateway
M/N: TMU-1500
Mode: WCDMA Band IV
Note:

Polarization: Conducted Power
Power: DC 12V
Distance:

Temperature: 26 ℃
Humidity: 55 %
RBW: 1000 KHz VBW: 3000 KHz

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	Detector	cm	degree	Comment
1	*	18785.625	-56.92	7.09	-49.83	-13.00	-36.83	peak			

*:Maximum data x:Over limit !:over margin



Site: site #1
Limit: FCC Part 27 conducted(9k-26.5G)
EUT: M2M Advanced Industrial Gateway
M/N: TMU-1500
Mode: WCDMA Band IV
Note:

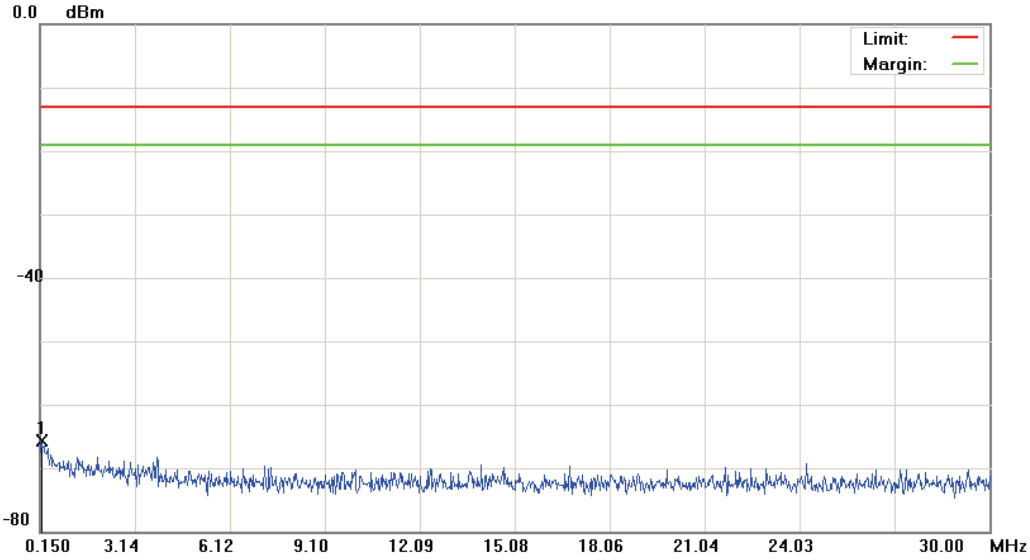
Polarization: Conducted Power
Power: DC 12V
Distance:

Temperature: 26 ℃
Humidity: 55 %
RBW: 1 KHz VBW: 3 KHz

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	Detector	cm	degree	Comment
1	*	0.0104	-79.37	11.34	-68.03	-13.00	-55.03	peak			

*:Maximum data x:Over limit !:over margin

File :TMU-1500(CH1413) Data :#2 Date: 2015/10/12 Time: 上午 11:18:04



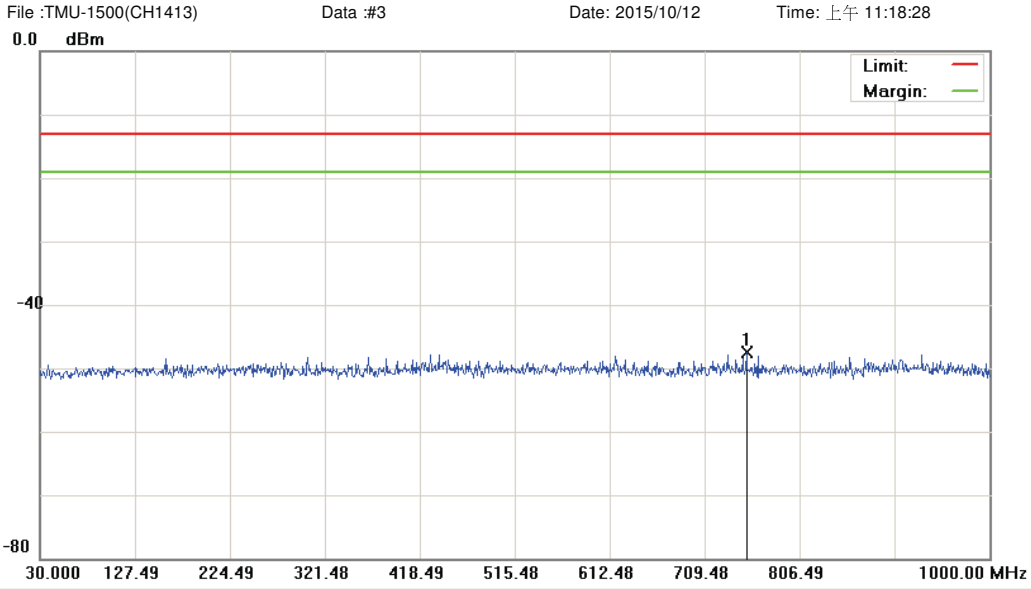
Site: site #1
Limit: FCC Part 27 conducted(9k-26.5G)
EUT: M2M Advanced Industrial Gateway
M/N: TMU-1500
Mode: WCDMA Band IV
Note:

Polarization: Conducted Power
Power: DC 12V
Distance:

Temperature: 26 ℃
Humidity: 55 %
RBW: 10 KHz VBW: 30 KHz

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	Detector	cm	degree	Comment
1	*	0.1948	-78.23	12.45	-65.78	-13.00	-52.78	peak			

*:Maximum data x:Over limit !:over margin



Site: site #1
Limit: FCC Part 27 conducted(9k-26.5G)
EUT: M2M Advanced Industrial Gateway
M/N: TMU-1500
Mode: WCDMA Band IV
Note:

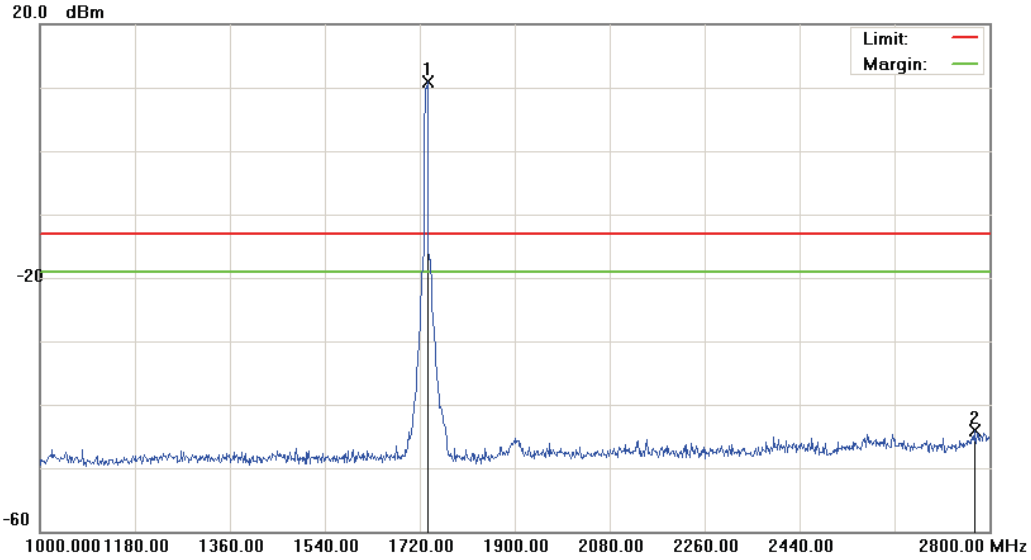
Polarization: Conducted Power
Power: DC 12V
Distance:

Temperature: 26 ℃
Humidity: 55 %
RBW: 100 KHz VBW: 300 KHz

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	Detector	cm	degree	Comment
1	*	751.6800	-60.61	13.17	-47.44	-13.00	-34.44	peak			

*:Maximum data x:Over limit !:over margin

File :TMU-1500(CH1413) Data :#4 Date: 2015/10/12 Time: 上午 11:24:35



Site: site #1
Limit: FCC Part 27 conducted(9k-26.5G)
EUT: M2M Advanced Industrial Gateway
M/N: TMU-1500
Mode: WCDMA Band IV
Note:

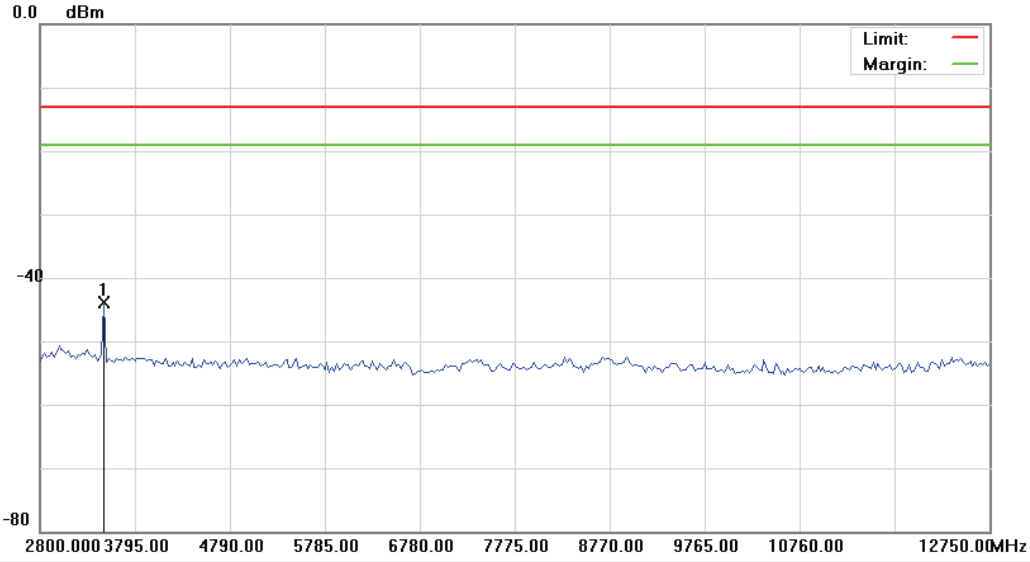
Polarization: Conducted Power
Power: DC 12V
Distance:

Temperature: 26 ℃
Humidity: 55 %
RBW: 1000 KHz VBW: 3000 KHz

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	Detector	cm	degree	Comment
1	*	1734.400	6.26	4.60	10.86	-13.00	23.86	peak			Tx
2		2771.200	-49.81	5.76	-44.05	-13.00	-31.05	peak			

*:Maximum data x:Over limit !:over margin

File :TMU-1500(CH1413) Data :#5 Date: 2015/10/12 Time: 下午 02:06:00



Site: site #1
Limit: FCC Part 27 conducted(9k-26.5G)
EUT: M2M Advanced Industrial Gateway
M/N: TMU-1500
Mode: WCDMA Band IV
Note:

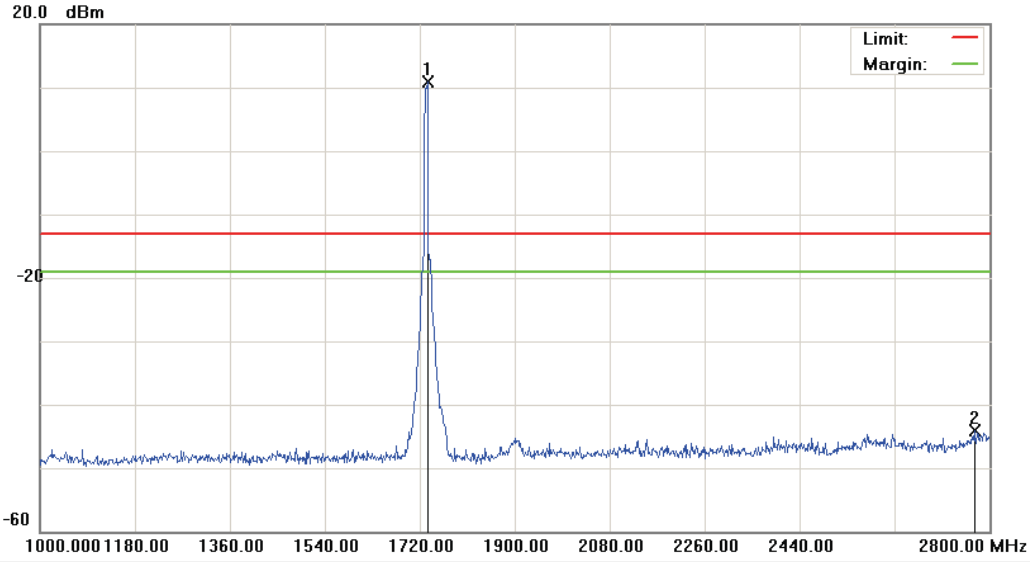
Polarization: Conducted Power
Power: DC 12V
Distance:

Temperature: 26 ℃
Humidity: 55 %
RBW: 1000 KHz VBW: 3000 KHz

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	Detector	cm	degree	Comment
1	*	3471.625	-48.92	5.03	-43.89	-13.00	-30.89	peak			

*:Maximum data x:Over limit !:over margin

File :TMU-1500(CH1413) Data :#4 Date: 2015/10/12 Time: 上午 11:24:35



Site: site #1
Limit: FCC Part 27 conducted(9k-26.5G)
EUT: M2M Advanced Industrial Gateway
M/N: TMU-1500
Mode: WCDMA Band IV
Note:

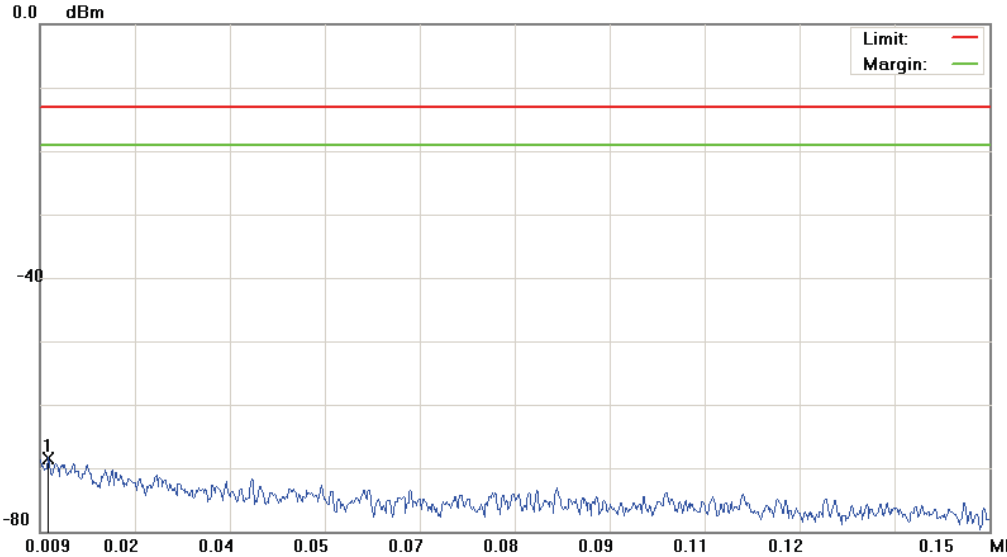
Polarization: Conducted Power
Power: DC 12V
Distance:

Temperature: 26 ℃
Humidity: 55 %
RBW: 1000 KHz VBW: 3000 KHz

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	Detector	cm	degree	Comment
1	*	1734.400	6.26	4.60	10.86	-13.00	23.86	peak			Tx
2		2771.200	-49.81	5.76	-44.05	-13.00	-31.05	peak			

*:Maximum data x:Over limit !:over margin

File :TMU-1500(CH1513) Data :#1 Date: 2015/10/12 Time: 上午 11:19:24



Site: site #1
Limit: FCC Part 27 conducted(9k-26.5G)
EUT: M2M Advanced Industrial Gateway
M/N: TMU-1500
Mode: WCDMA Band IV
Note:

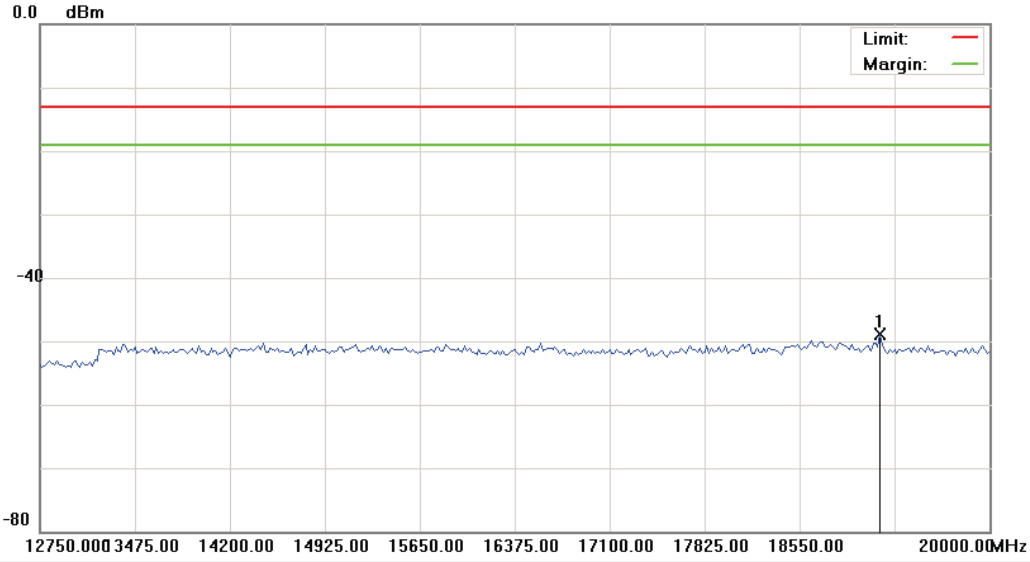
Polarization: Conducted Power
Power: DC 12V
Distance:

Temperature: 26 ℃
Humidity: 55 %
RBW: 1 KHz VBW: 3 KHz

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	Detector	cm	degree	Comment
1	*	0.0103	-79.74	11.34	-68.40	-13.00	-55.40	peak			

*:Maximum data x:Over limit !:over margin

File :TMU-1500(CH1413) Data :#6 Date: 2015/10/12 Time: 下午 02:06:20



Site: site #1
Limit: FCC Part 27 conducted(9k-26.5G)
EUT: M2M Advanced Industrial Gateway
M/N: TMU-1500
Mode: WCDMA Band IV
Note:

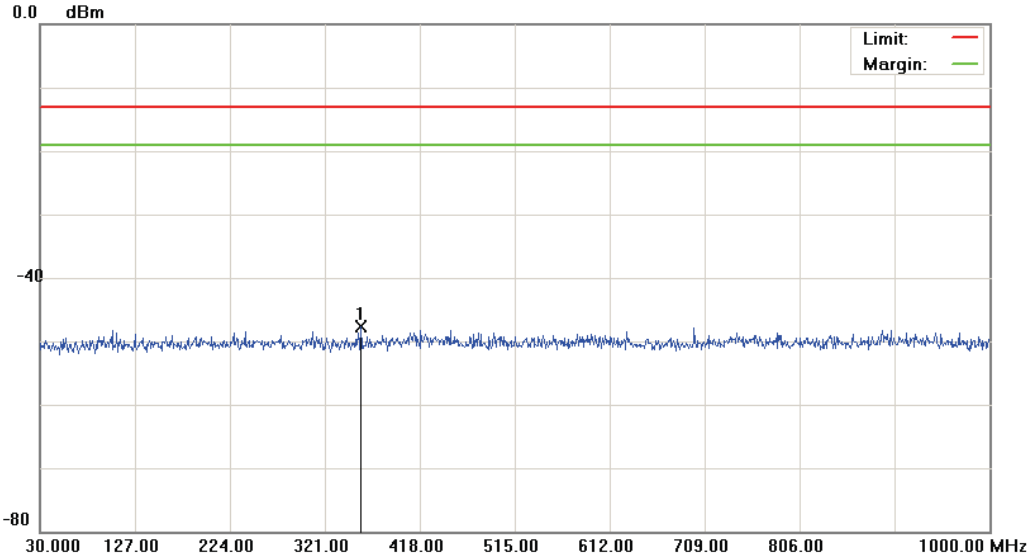
Polarization: Conducted Power
Power: DC 12V
Distance:

Temperature: 26 ℃
Humidity: 55 %
RBW: 1000 KHz VBW: 3000 KHz

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	Detector	cm	degree	Comment
1	*	19166.250	-56.18	7.20	-48.98	-13.00	-35.98	peak			

*:Maximum data x:Over limit !:over margin

File :TMU-1500(CH1513) Data :#3 Date: 2015/10/12 Time: 上午 11:20:12



Site: site #1
Limit: FCC Part 27 conducted(9k-26.5G)
EUT: M2M Advanced Industrial Gateway
M/N: TMU-1500
Mode: WCDMA Band IV
Note:

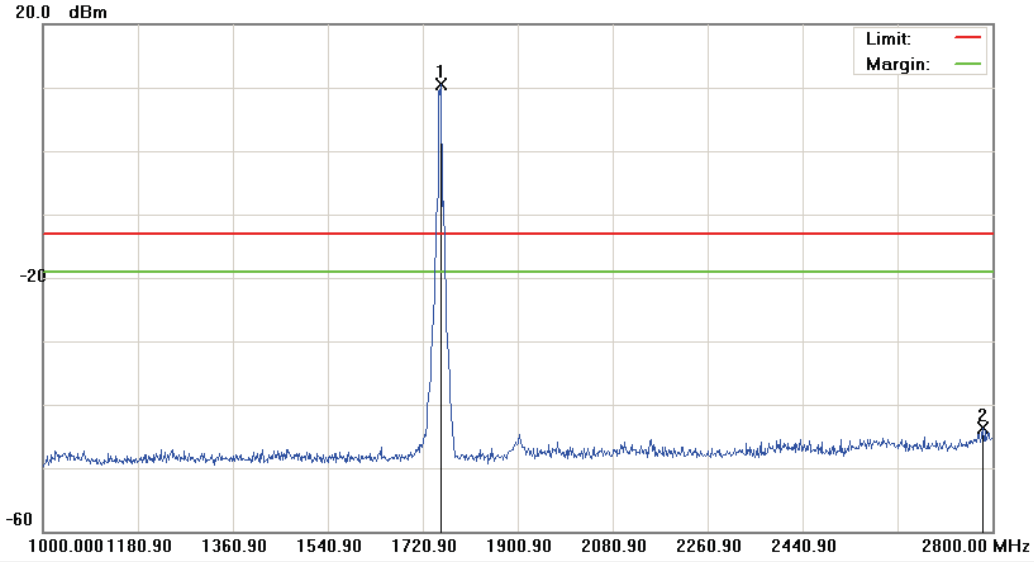
Polarization: Conducted Power
Power: DC 12V
Distance:

Temperature: 26 ℃
Humidity: 55 %
RBW: 100 KHz VBW: 300 KHz

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	Detector	cm	degree	Comment
1	*	357.8600	-60.81	13.18	-47.63	-13.00	-34.63	peak			

*:Maximum data x:Over limit !:over margin

File :TMU-1500(CH1513) Data :#4 Date: 2015/10/12 Time: 上午 11:33:43



Site: site #1
Limit: FCC Part 27 conducted(9k-26.5G)
EUT: M2M Advanced Industrial Gateway
M/N: TMU-1500
Mode: WCDMA Band IV
Note:

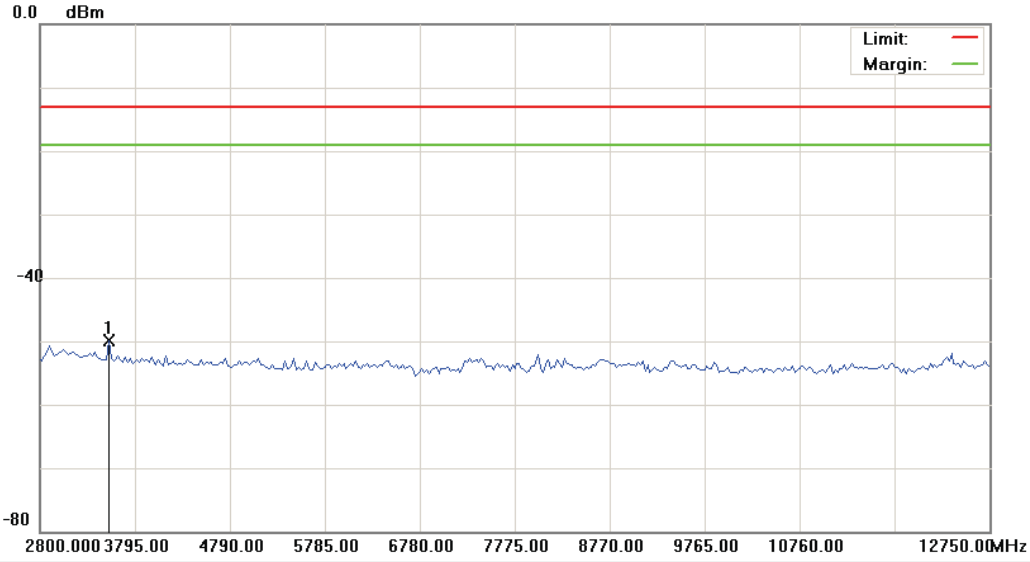
Polarization: Conducted Power
Power: DC 12V
Distance:

Temperature: 26 ℃
Humidity: 55 %
RBW: 1000 KHz VBW: 3000 KHz

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	Detector	cm	degree	Comment
1	*	1754.200	5.80	4.62	10.42	-13.00	23.42	peak			Tx
2		2782.000	-49.55	5.88	-43.67	-13.00	-30.67	peak			

*:Maximum data x:Over limit !:over margin

File :TMU-1500(CH1513) Data :#5 Date: 2015/10/12 Time: 下午 02:06:51



Site: site #1
Limit: FCC Part 27 conducted(9k-26.5G)
EUT: M2M Advanced Industrial Gateway
M/N: TMU-1500
Mode: WCDMA Band IV
Note:

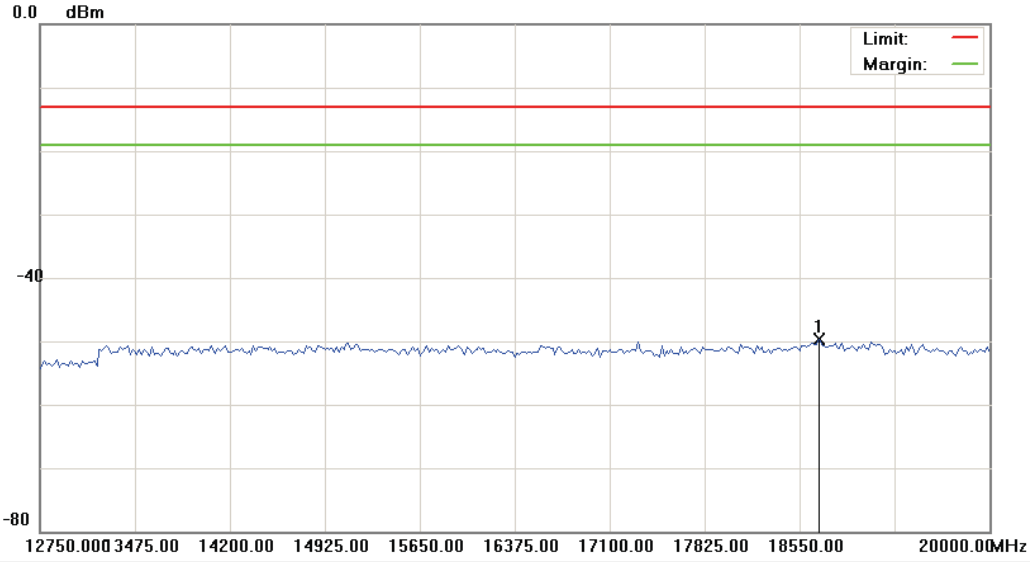
Polarization: Conducted Power
Power: DC 12V
Distance:

Temperature: 26 ℃
Humidity: 55 %
RBW: 1000 KHz VBW: 3000 KHz

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	Detector	cm	degree	Comment
1	*	3521.375	-54.82	4.95	-49.87	-13.00	-36.87	peak			

*:Maximum data x:Over limit !:over margin

File :TMU-1500(CH1513) Data :#6 Date: 2015/10/12 Time: 下午 02:07:11



Site: site #1
Limit: FCC Part 27 conducted(9k-26.5G)
EUT: M2M Advanced Industrial Gateway
M/N: TMU-1500
Mode: WCDMA Band IV
Note:

Polarization: Conducted Power
Power: DC 12V
Distance:

Temperature: 26 ℃
Humidity: 55 %
RBW: 1000 KHz VBW: 3000 KHz

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBm	dB	dBm	dBm	dB	Detector	cm	degree	Comment
1	*	18695.000	-56.75	7.07	-49.68	-13.00	-36.68	peak			

*:Maximum data x:Over limit !:over margin

8 Field Strength of Spurious Radiation Test

8.1. Limit

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10log(P) dB.
It is measured by means of a calibrated spectrum analyzer and scanned from 30 MHz up to a frequency including its 10th harmonic.

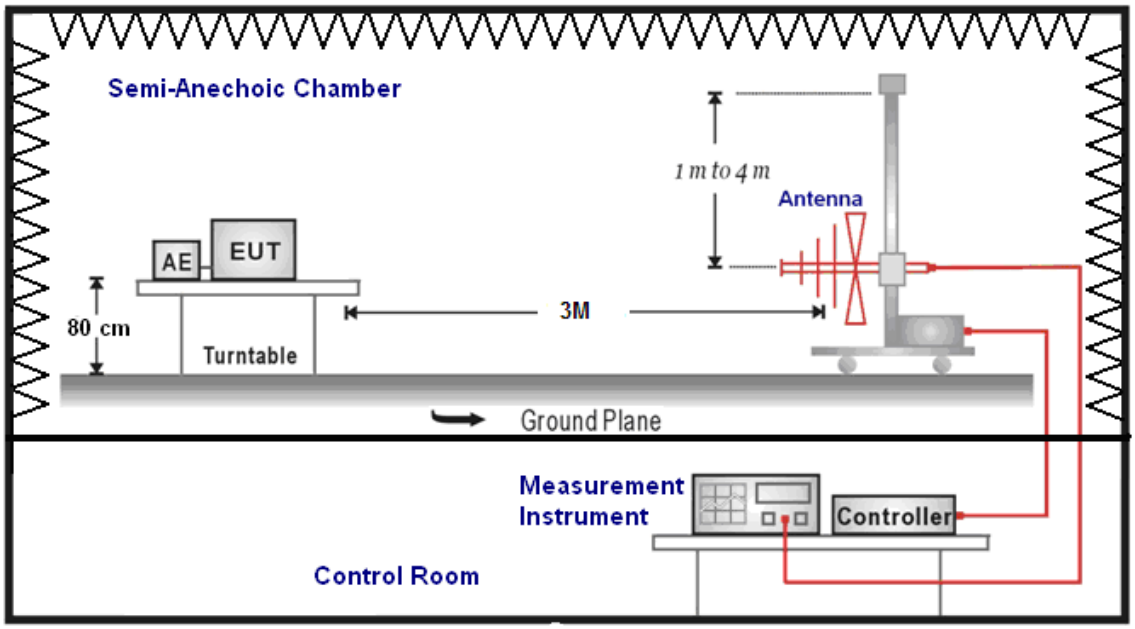
8.2. Test Instruments

3 Meter Chamber					
Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
RF Pre-selector	Agilent	N9039A	MY46520256	01/06/2015	(1)
Spectrum Analyzer	Agilent	E4446A	MY46180578	01/06/2015	(1)
Pre Amplifier	Agilent	8449B	3008A02237	02/24/2015	(1)
Pre Amplifier	Agilent	8447D	2944A10961	02/24/2015	(1)
Broadband Antenna (30MHz~1GHz)	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	9163-270	08/11/2015	(1)
Sleeve Dipole(CF880) (780-980MHz)	ETS	3126-880	00064344	10/06/2014	(2)
Sleeve Dipole(CF1845) (1695-1995MHz)	ETS	3126-1845	00083335	10/06/2014	(2)
Horn Antenna (1~18GHz)	ETS	3117	00152321	08/14/2015	(1)
Horn Antenna (1~18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA9120D	9120D-550	06/12/2015	(1)
Horn Antenna (18~40GHz)	ETS	3116	00086467	09/01/2015	(1)
Horn Antenna (18~40GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA9170	9170-320	07/06/2015	(1)
Test Site	ATL	TE01	888001	08/27/2015	(1)

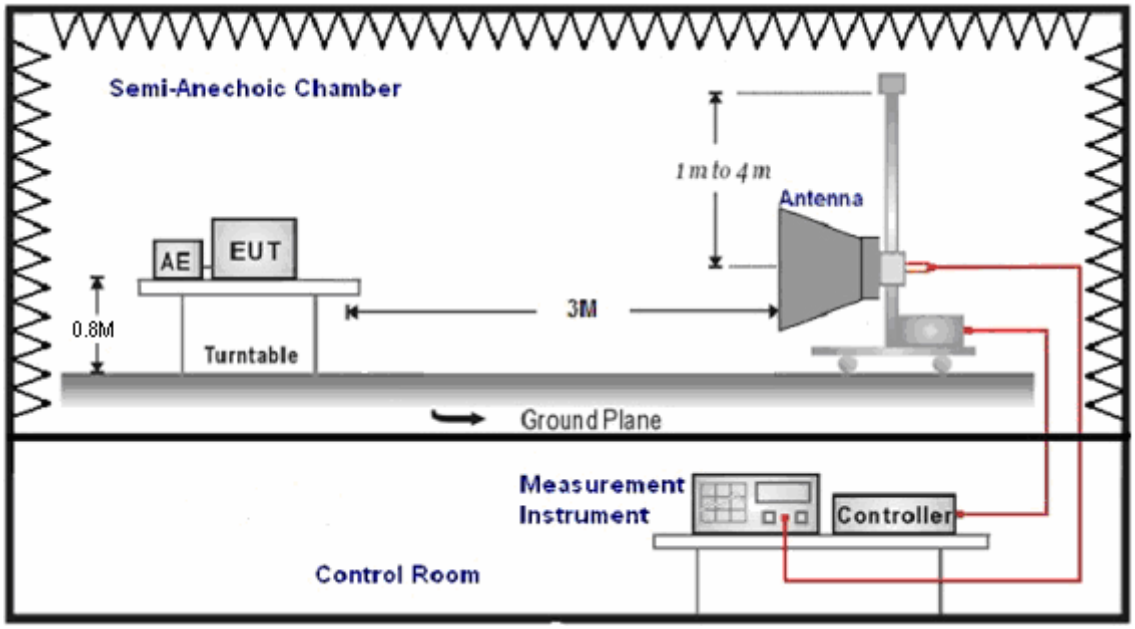
Remark: (1) Calibration period 1 year. (2) Calibration period 2 years.
Note: N.C.R. = No Calibration Request.

8.3. Setup

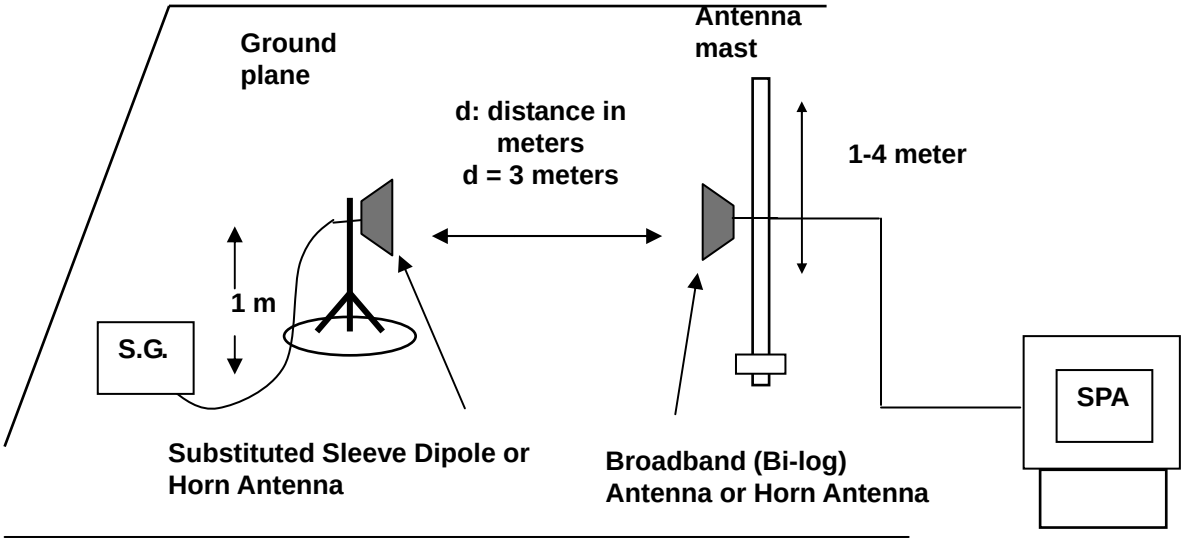
Below 1GHz



Above 1GHz



For Substituted Method Test Set-UP



8.4. Test Procedure

a. The EUT was set up for the maximum power. The power was measured with Spectrum Analyzer. All measurements were done at 3 channels (low, middle and high operational frequency range). RWB and VBW is 1MHz.

b. Radiation Emission measurement. In the semi-anechoic chamber, EUT placed on the 0.8m height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power. The “Read Value” is the spectrum reading the maximum power value.

c. The substitution antenna (Note:1 & 2) is substituted for EUT at the same position and signals generator export the CW signal to the substitution antenna via a TX cable. Rotated the Turn Table and moved receiving antenna to find the maximum radiation power. Adjust output power level of S.G to get a Value of spectrum reading equal to “Read Value” of step a. Record the power level of S.G.

d. E.I.R.P. = Output power level of S.G - TX cable loss + Antenna gain of substitution horn

e. E.R.P. = E.I.R.P- 2.15 dB

Note: 1. Below 1 GHz Substituted Method Test：Sleeve dipole antenna to Bi-Log Antenna

2. Above 1 GHz Substituted Method Test：Horn antenna to Horn Antenna

8.5. Uncertainty

The measurement uncertainty is defined as for Field Strength of Spurious Radiation measurement is ± 3.072 dB.

8.6. Test Result

Standard:	FCC Part 27	Test Distance:	3m
Test item:	Radiated Emission	Power:	DC 12V
Model Number:	TMU-1500	Temp.(℃)/Hum.(%RH):	26(℃)/60%RH
Mode:	1	Date:	12/05/2015
Frequency:	1712.4 MHz	Test By:	Eric Ou Yang

Frequency (MHz)	Reading (dBm)	Correct Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark	Ant.Polar. H / V
3424.800	-50.72	15.55	-35.17	-13.00	-22.17	peak	H
3424.800	-45.21	15.55	-29.66	-13.00	-16.66	peak	V

Standard:	FCC Part 27	Test Distance:	3m
Test item:	Radiated Emission	Power:	DC 12V
Model Number:	TMU-1500	Temp.(℃)/Hum.(%RH):	26(℃)/60%RH
Mode:	1	Date:	12/05/2015
Frequency:	1732.6 MHz	Test By:	Eric Ou Yang

Frequency (MHz)	Reading (dBm)	Correct Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark	Ant.Polar. H / V
3465.800	-53.61	15.75	-37.86	-13.00	-24.86	peak	H
3465.800	-44.72	15.75	-28.97	-13.00	-15.97	peak	V

Standard:	FCC Part 27	Test Distance:	3m
Test item:	Radiated Emission	Power:	DC 12V
Model Number:	TMU-1500	Temp.(℃)/Hum.(%RH):	26(℃)/60%RH
Mode:	1	Date:	12/05/2015
Frequency:	1752.6 MHz	Test By:	Eric Ou Yang

Frequency (MHz)	Reading (dBm)	Correct Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark	Ant.Polar. H / V
3505.200	-54.12	15.90	-38.22	-13.00	-25.22	peak	H
3505.200	-44.59	15.90	-28.69	-13.00	-15.69	peak	V

9 Frequency Stability (Temperature & Voltage Variation) Test

9.1. Limit

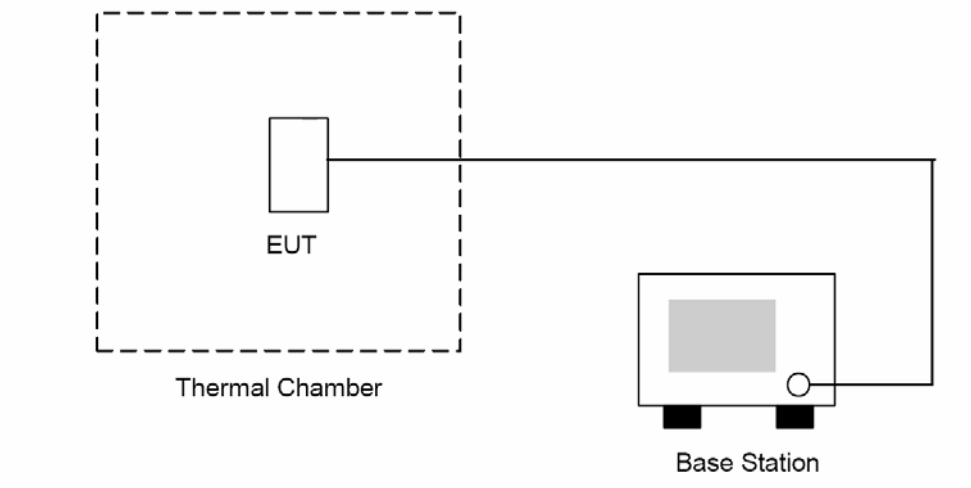
The frequency stability shall be measured by variation of ambient temperature and variation of primary supply voltage to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within ±0.00025% (±2.5ppm) of the center frequency.

9.2. Test Instruments

Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Remark
Universal Radio Communication Tester	R & S	CMU200	109369	10/21/2014	(2)
Temperature & Humidity Chamber	TAICHY	MHU-225LA	980729	04/27/2015	(1)
Test Site	ATL	TE05	TE05	N.C.R.	-----

Remark: (1) Calibration period 1 year. (2) Calibration period 2 years.
Note: N.C.R. = No Calibration Request.

9.3. Setup



9.4. Test Procedure

The measurement is made according to FCC rules part 27:

1. The EUT and test equipment were set up as shown on the following section.
2. With all power removed, the temperature was decreased to -30℃ and permitted to stabilize for three hours. Power was applied and the maximum change in frequency was note within one minute.
3. With power OFF, the temperature was raised in 10℃ steps. The sample was permitted to stabilize at each step for at least one-half hour. Power was applied and the maximum frequency change was noted within one minute.
4. The EUT was placed in a temperature chamber at 25±5 ℃ and connected as the following section.
5. The power supply voltage to the EUT was varied from BEP to 115% of the nominal value measured at the input to the EUT.
6. The temperature tests were performed for the worst case.
7. Test data was recorded.

9.5. Uncertainty

The measurement uncertainty is defined as for Frequency Stability (Temperature Variation) measurement is ± 10Hz.

9.6. Test Result

Model Number	TMU-1500					
Test Item	Frequency Stability (Temperature & Voltage Variation)					
Test Mode	Mode 1					
Date of Test	10/12/2015				Test Site	TE05
Level	Voltage [Vdc]	Temperature (℃)	Deviation (Hz)	Deviation (ppm)	Limit (ppm)	Result
Normal	12.00	-30	5.24	0.003	±2.5	Pass
Normal	12.00	-20	8.87	0.005	±2.5	Pass
Normal	12.00	-10	-4.38	-0.003	±2.5	Pass
Normal	12.00	0	1.23	0.001	±2.5	Pass
Normal	12.00	10	-9.59	-0.006	±2.5	Pass
Battery full point	32.00	20	8.14	0.005	±2.5	Pass
Normal	12.00	20	-9.69	-0.006	±2.5	Pass
Battery cut-off point	5.00	20	-4.33	-0.002	±2.5	Pass
Normal	12.00	30	-4.18	-0.002	±2.5	Pass
Normal	12.00	40	-8.74	-0.005	±2.5	Pass
Normal	12.00	50	-0.86	0.000	±2.5	Pass